INSTRUCTION MANUAL

R. L. DRAKE • MODEL

TR-4

SIDEBAND TRANSCEIVER

STANDARD WARRANTY

R. L. DRAKE COMPANY warrants each new radio product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use, and service discloses such defect, provided the unit is delivered by the owner to us or to our authorized radio dealer or wholesaler from whom purchased, intact, for our examination, with all transportation charges prepaid to our factory, within ninety days from the date of sale to original purchaser and provided that such examination discloses in our judgement that it is thus defective. Should a malfunction be suspected, write in detail to our Service Department for suggestions concerning the operation, repair or return of your unit if it should prove necessary.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside our factory, nor in cases where the serial number thereof has been removed, defaced or changed, nor to units used with accessories not manufactured or recommended by us.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products.

The R. L. DRAKE COMPANY reserves the right to make any improvements to its products which it may deem desirable without obligating itself to install such improvements in its previously manufactured products.

R. L. DRAKE COMPANY MIAMISBURG, OHIO 45342

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GENERAL SPECIFICATIONS

FREQUENCY COVERAGE

Full coverage on all amateur bands 10 through 80 meters, in seven 600 kHz ranges: 3.5 to 4.1 MHz, 7.0 to 7.6 MHz, 13.9 to 14.5 MHz, 21.0 to 21.6 MHz, 28.0 to 28.6 MHz, 28.5 to 29.1 MHz, 29.1 to 29.7 MHz.

SOLID STATE VFO

Has linear permeability tuning. Tunes 4.9 to 5.5 MHz for all ranges.

DIAL CALIBRATION

10 kHz divisions on Main Tuning dial and 1 kHz on tuning knob skirt. Effective length of circular dial scale is over 14 inches.

FREQUENCY STABILITY

High stability solid state VFO tunes same range on all bands. Overall drift is less than 100 Hz after warm-up, and less than 100 Hz for ± 10% line voltage change.

MODES OF OPERATION SSB (Upper or Lower Sideband), CW, and AM.

FRONT PANEL CONTROLS

MAIN TUNING

Fluted knob with adjustable 25 division skirt. Tunes VFO and rotates main dial.

RF TUNE

Tunes the RF circuits common to receiver RF amplifier and transmitter driver stages. 0 - 10 scale.

PLATE AND LOAD

These tuning controls adjust pi-network capacitors in transmitter for proper resonance and loading on each band.

BAND

This switch selects desired ham band (see "Frequency Coverage" above).

FUNCTION

This switch has four positions; CAL, SSB, X-CW, X-AM.

1. CAL operates built-in 100 kHz crystal calibrator for accurate setting of Main Tuning hair line indicator and knob skirt.
2. SSB provides SSB operation, either VOX or PTT.
3. X-CW provides for CW operation with automatic transmit receive switching and CW sidetone, and is used for tune up.
4. X-AM provides controlled carrier AM operation with VOX or PTT, and with diode detector for receiving.

FRONT PANEL CONTROLS (Continued)

XMTR GAIN

Functions as mike audio gain on SSB and AM, and as carrier injection control on CW.

RCVR GAIN

Knob controls receiver AF Gain and Power ON-OFF switch. Lever behind knob controls setting of RF Gain.

SIDEBAND

Switch in conjunction with indicator lights marked "Upper" and "Lower", selects desired sideband by connecting into the circut either the upper or lower sideband filter. ("X" position used when in "X-CW" or "X-AM" positions of Function Switch.)

OUTPUT METER CONTROL

This switch converts plate meter to read relative output, when pushed. Rotating varies output meter sensitivity.

RIGHT SIDE SCREWDRIVER ADJUST CONTROLS

Vox Gain, Anti Vox Gain, S-Meter Zero.

RIGHT SIDE JACKS

Headphone (disconnects speaker circuit), Microphone (3-circuit for PTT), Key (normally closed).

REAR CONTROLS

Sidetone (adjusts sidetone volume), Lights (for dimming dial lights).

REAR JACKS

POWER (connects TR-4 to power supply and speaker),
RCVR MUTE (for muting an external receiver),
RCVR ANT (Uses TR-4 antenna relay to connect an external receiver to antenna),
ANTENNA (for connecting the TR-4 to the antenna).

LEFT SIDE CONTROLS

TCVR/RCVR switch (for selecting between the use of the TR-4 or an external receiver for receiving).

INSIDE CONTROLS

Carrier Balance

FRONT PANEL CONTROLS (Continued)

METERS

Receiver -	S-Meter/Transmitting AGC Indicator, and
Transmitter -	Plate Ammeter/Relative RF Output Indicator.

MISCELLANEOUS

Twenty tubes including voltage regulator; five transistors, ten diodes; one 100 kHz crystal calibrator built-in.

DIMENSIONS

5-1/2"	High
10-3/4"	Wide
14-3/8"	Deep

WEIGHT

16 pounds

TRANSMITTER SPECIFICATIONS

SINGLE SIDEBAND

300 Watts PEP input power, VOX or PTT. Two special 9 MHz crystal filters provide upper or lower sideband selection on any band, without the necessity of shifting oscillators. Unwanted sideband suppression of more than 60 dB and carrier suppression of 50 dB. Overall audio frequency response 400 to 2500 Hz at 6 dB down. Distortion products 30 dB down at maximum output.

CW

Power input 260 Watts. Carrier is shifted approximately 1000 Hz into one sideband, and mixer and driver are keyed. Grid block keying is free from chirps and is properly shaped to minimize clicks. Automatic transmit/receive switching when key is operated. CW sidetone oscillator for monitoring.

AM

Controlled carrier AM screen modulator is built-in. 260 Watts PEP input. Low carrier power increases 6 times to 50 watts output at maximum modulation. This system is compatible with SSB linears. VOX or PTT. Diode detector used for receiving on this mode. Product Detector can be used by switching manually.

OUTPUT IMPEDANCE

Nominal 50 ohms, adjustable with pi-network.

MICROPHONE INPUT

High-impedance.

RECEIVER SPECIFICATIONS

SENSITIVITY
Less than 1/2 Microvolt for 10 dB S+N/N.

AGC
Full AGC on received modes. Audio output varies less than 3 dB for 60 dB change in signal level. Any amount of AGC from zero to full can be obtained by adjustment of RF Gain control. Time proven Drake AGC system provides fast attack and slow release with noise pulse suppression. No pumping or popping evident.

ANTENNA INPUT
Nominal 50 Ohms.

AUDIO RESPONSE
400 to 2500 Hz at 6 dB.

AUDIO OUTPUT POWER
2 Watts.

AUDIO OUTPUT IMPEDANCE
4 Ohms.

POWER SUPPLY REQUIREMENTS
Due to the 300 Watt PEP input rating, the TR-4 will require a power supply capable of low voltage at high current with very good dynamic regulation. The voltage and current requirements are as follows:

1. 650 Volts at 300 mA average and 500 mA maximum with 10% regulation from 100 mA to 500 mA and maximum ripple of less than 1%.
2. 250 Volts at 175 mA with 10% regulation from 150 mA to 180 mA. This includes the effect of the 650 Volt supply change if both voltages are obtained from the same transformer. Maximum ripple must be less than 1/4%.
3. -45 to -65 VDC adjustable filtered bias into 33 K Ohm load.
4. 12.6 Volt AC or DC at 5.5 Amps.

TUBE AND TRANSISTOR COMPLEMENT	FUNCTION	
	TRANSMITTER	RECEIVER
12AX7	Mike Amplifier	----
6EV7	Vox Amp/Relay	----
6GX6	9 MHz Xtal Osc.	BFO/Prod. Det.
12BA6	IF Amplifier	----
12BA6	----	IF Amplifier
6BZ6	----	IF Amplifier
12AX7	AGC	AGC
6AQ5A	Anti-Vox	Audio Output
6EJ7	Mixer	----
6EA8	Cathode Fol.	Mixer/Cath. Fol.
6EA8	Pre-Mixer/Xtal Osc.	Pre-Mixer/Xtal Osc.
12AV6	Sidetone Osc.	Diode Det/1st AF Amp
13DE7	AM Screen Mod.	----
12BA6	----	RF Amp.
6BA6	----	Crystal Calib.
12BY7	Driver	----
(3) 6JB6 Matched	Power Amps.	----
OA2	Voltage Reg.	Voltage Reg.
2N5950	VFO	VFO
2N3563	VFO Buffer	VFO Buffer
2N3394	VFO Shut Off	VFO Shut Off
AT5059	Neon Driver	Neon Driver
2N3877	----	Audio Pre-Amp

I. GENERAL DESCRIPTION

The R. L. Drake Company model TR-4 is a single sideband transceiver designed for the transmission and reception of upper and lower sideband signals on the 80 through 10 meter amateur bands. AM and CW capabilities are included.

Its compact size makes it ideal for both fixed station use in conjunction with our model AC-4 120/240 Volt, 50/60 Hz, AC power supply, or for mobile installations using our model DC-4 or DC-24,12 Volt DC power supply.

The 300 Watt PEP input on SSB enables the TR-4 to give an excellent account of itself "barefoot" and it will drive the highest powered ham linear amplifiers.

Upper and lower sideband selection is accomplished by switching between two 9 MHz crystal lattice filters with 2.1 kHz passbands. Among the other features included on the TR-4 are VOX and PTT on SSB and AM, diode detection for AM, shifted carrier CW, automatic transmit/receive switching on CW, built in CW sidetone, separate RF and AF gain controls, solid state VFO with linear permeability tuning, transmitting and receiving AGC indicator and plate ammeter/RF output indicator, adjustable pi-network output, and built in crystal calibrator.

The addition of the accessory RV-4 remote VFO speaker combination enables the operator to receive, transmit, or transceive throughout the band being used without disturbing the setting of the TR-4 tuning dial. This is useful for working DX stations operating outside the United States phone bands, or for working near your own frequency in search of a clear spot under crowded band conditions.

The accessory FF-1 is a fixed frequency adapter useful wherever crystal controlled operation is desired. It provides two switch selected channels and allows "off", crystal controlled "transmit" only or "transceive" operation.

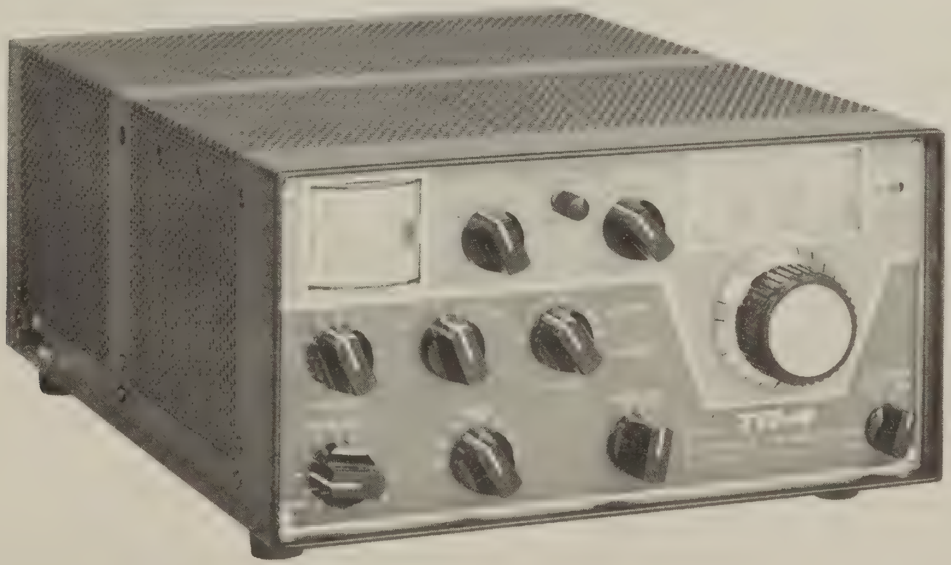


FIGURE 1. FRONT VIEW OF TR-4 TRANSCEIVER

II. INSTALLATION INSTRUCTIONS

A. UNPACKING - Carefully remove your TR-4 from its packing material and examine it closely for signs of shipping damage. Should any be apparent, notify the delivering carrier immediately, stating the full extent of the damage.

Fill out and mail the enclosed registration card so that your warranty will be effective.

Save the packing material. You may need it later for reshipment or storage.

Inspect the packing material closely before putting it away to be sure you have not overlooked the Switchcraft type S-230 and 229 plugs and other hardware shipped with the TR-4.

B. ANTENNA REQUIREMENTS

The TR-4 is designed for use with antennas resonant on the operating frequency and having approximate impedances of from 30 to 100 Ohms. The SWR should be 2:1 or less. Although there are many types of antennas which will meet this requirement, the simplest is a one half (1/2) wave dipole, center fed with 52 Ohm coax. For a detailed discussion on antennas, we suggest you refer to the ARRL Antenna Book or The Radio Amateur's Handbook.

Antenna connection to the TR-4 is provided at the SO-239 coax connector located on the rear of the shielded compartment housing the final amplifier components.

> CAUTION: NEVER ATTEMPT TO OPERATE THE TR-4 WITHOUT FIRST CONNECTING IT TO AN ANTENNA OR 52 OHM DUMMY LOAD OF SUFFICIENT POWER HANDLING CAPACITY OR SERIOUS DAMAGE CAN RESULT!

C. SPEAKER REQUIREMENTS

A good quality 4 Ohm speaker should be connected to terminals 7 and 12 of the female power plug mated to the TR-4, or plugged into the phone jack on the side. If our model AC-4 or DC-4 power supplies are used, a 6-inch lead terminating in a female phono plug is attached to these terminals of the power plug on the end of the power cable. Our model MS-4 speaker, available from your dealer, provides a very good match and is compatible in appearance with the TR-4. It will also house the model AC-4, 120 VAC power supply.

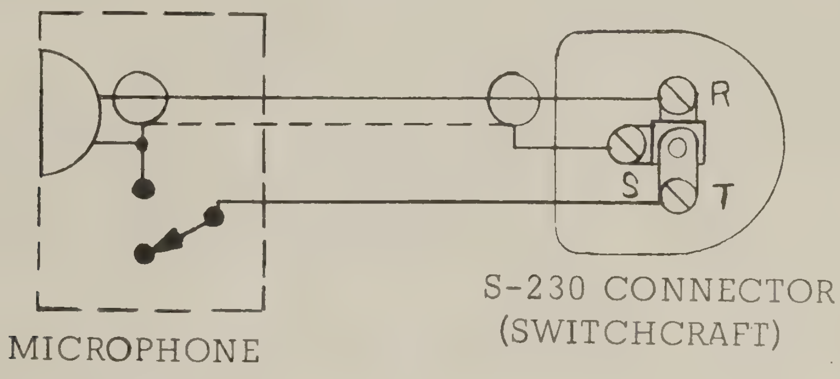
D. MICROPHONE REQUIREMENTS

A microphone with a wide and flat frequency response will enable you to obtain peak performance from your TR-4. For good VOX (voice control), it

D. MICROPHONE REQUIREMENTS (Continued)

is desirable for the microphone to have a cardiod pattern to reduce pickup from the back and sides. This enables you to operate with higher receiver audio gain, giving better VOX operation and reducing echoes, reverberation, and noise pickup in the fixed or mobile installation. Microphones with limited low or high frequency response and with peaks in the voice range should be avoided.

A three conductor microphone plug (Switchcraft type S-230) is provided with the TR-4. The microphone must be connected as shown here for proper VOX and push to talk operation. Many microphones that are furnished with a switch are wired so that the microphone cartridge is open or short circuited unless the switch is depressed. This function must be defeated or VOX operation will be impossible.



E. LOCATION

In general, the location of the TR-4 is not critical, either in fixed or mobile installations. However, care should be taken to insure that space is allowed around the unit to allow adequate air circulation. Extremely hot locations, such as near radiators or heating units, should be avoided. Do not cover the top of the TR-4 with books, papers, or pieces of equipment or overheating may result.

F. FIXED INSTALLATION

For fixed installation, our model AC-4, 120 VAC 50/60 Hz power supply will be required and the model MS-4 matching speaker is highly desirable. Connect these units as shown in Figure 1. Note that the AC-4 power supply will fit inside the MS-4 to form one compact unit. Figure 2 shows how the TR-4 can be connected for operation with linear amplifiers. If you use a linear amplifier which has ALC output, it can be applied to the TR-4 through the ALC jack on the back of the AC-4. The use of shielded wire is recommended.

G. MOBILE INSTALLATION

The TR-4 may be installed in any vehicle having a 12 VDC electrical system. Our model DC-4 power supply will be required for this installation. All DC-4 supplies are factory wired for negative ground systems.

IF YOUR CAR HAS A POSITIVE GROUND SYSTEM, DO NOT ATTEMPT TO CONNECT THE DC-4 OR SERIOUS DAMAGE WILL RESULT!

1. Mount the TR-4 in a convenient location under the dash using the MMK-3 mobile mounting kit. See Figure 5 for more detailed instructions on various suggested mounting methods. Be sure to allow adequate clearance for air circulation and at the right side for access to the screw driver adjustments and the mike jack.

2. The recommended mounting position for the DC-4 power supply is on the passenger side of the firewall. We do not recommend that it be placed in the trunk due to the excessive primary lead length or in the engine compartment unless it is protected from water and engine heat.

   Make sure that the ON-OFF switch on the TR-4 is in the OFF position, (Audio Gain fully counter clockwise until click is heard), and connect the female power connector on the end of the power cable to the TR-4. Coil up excess cable and tape in an out-of-the-way location. You may need the extra length when you trade cars. Run the black wire from the power supply to a convenient ground and run the red wire through the fire wall to the battery terminal of the starter relay. Shorten the heavy red and black wires as much as possible.

3. Install a mobile antenna in the manner recommended by the antenna manufacturer and connect the coax lead from it to the SO-239 connector of the TR-4. It may be necessary to install a matching coil at the antenna feed point in order to match it to the feed line impedance (See Figure 4). The use of an SWR bridge is recommended. For details on this, refer to the mobile antenna section of the ARRL Radio Amateur's Handbook.

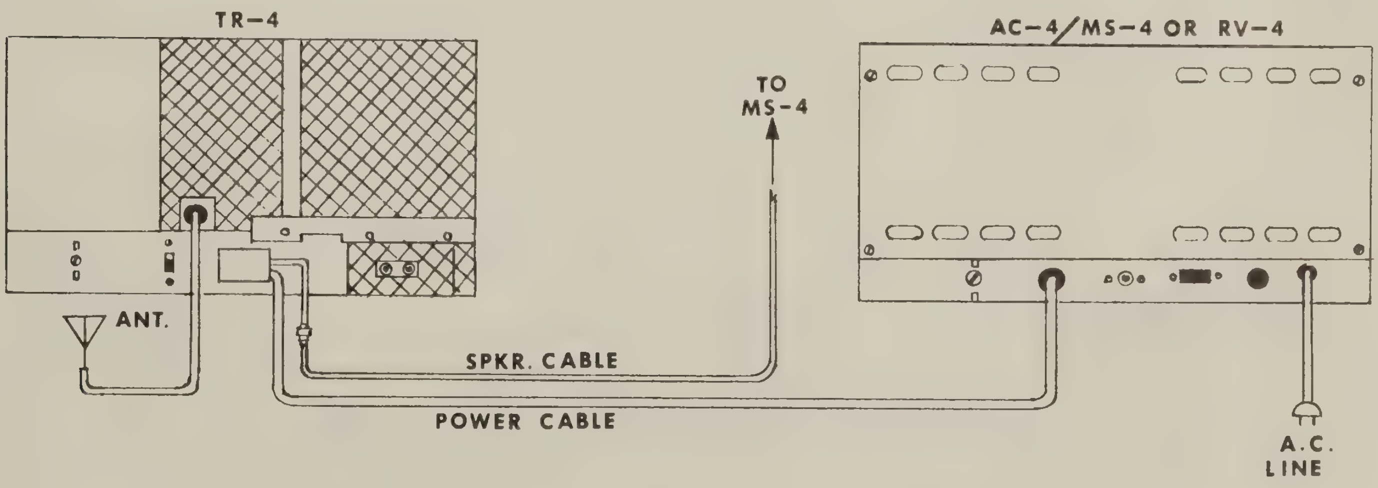
4. If your car has a transistor radio, we suggest you install a separate speaker for use with the TR-4. However, if the radio in your car has a vacuum tube audio amplifier, and if one side of its speaker is grounded, run a wire from the ungrounded terminal to the center conductor of a male phone plug. Insert the plug in the female jack molded into the end of the 6 inch wire protruding from the connector on the end of the DC-4 power cable. It should be unnecessary to disconnect the auto radio output transformer when the TR-4 is used, unless it has insufficient volume. If this proves to be the case, a SPDT switch can be installed so that the speaker lead goes to the pole, the car radio

G. MOBILE INSTALLATION (Continued)

4. (continued) output goes to one contact and the TR-4 output goes to the remaining contact.

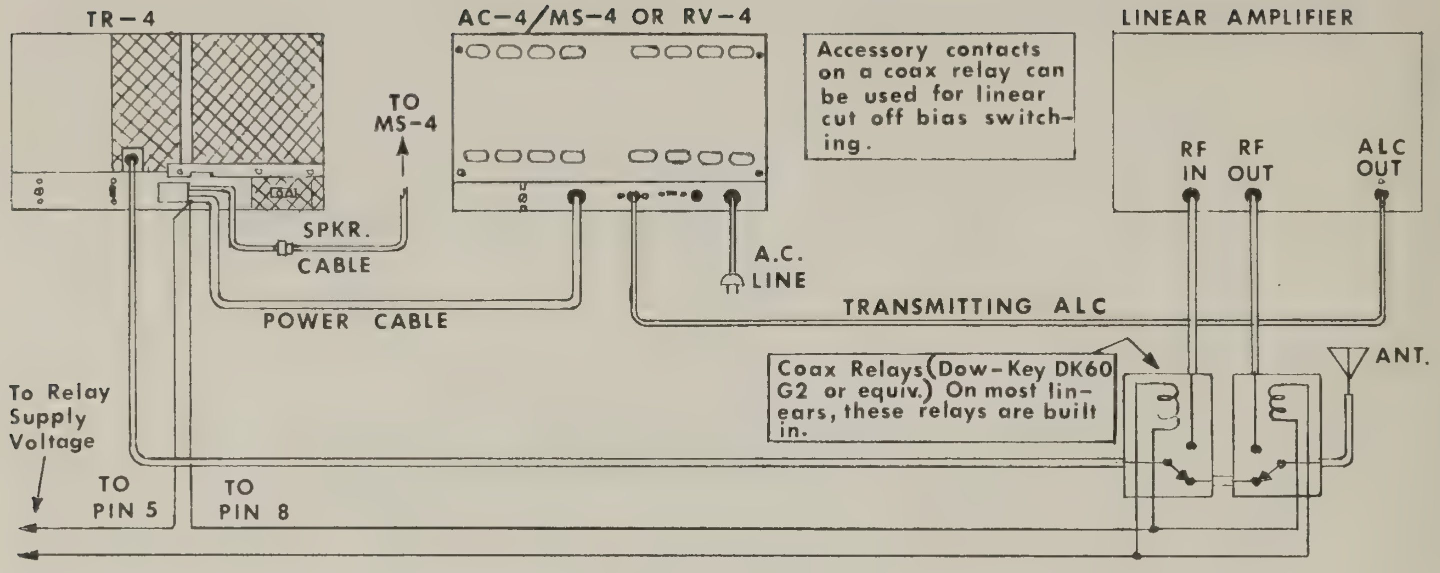
5. If ignition noise is a problem, we recommend the installation of a resistor type spark plugs, a 10,000 Ohm suppressor resistor inserted in the center tower of the distributor and 5,000 Ohm suppressor resistors at each spark plug tower on the distributor. Install a coaxial capacitor at the ignition coil primary as close to the coil terminal as possible.

   To suppress generator noise, install another coaxial capacitor (.1 to .25 mfd) in the generator output lead as close to the output terminal as possible. To suppress voltage regulator noise, install bracket mounted coaxial capacitors at the generator output and battery leads to the voltage regulator. Mount the capacitors as close to the regulator as possible. A .002 mfd mica capacitor with a 4 Ohm carbon resistor in series should be connected from the generator field terminal of the regulator to ground. Do not use a capacitor across the field contacts without a resistor in series or the regulator life will be greatly shortened! For additional information on noise suppression, consult the mobile noise suppression section of the ARRL Radio Amateur's Handbook.



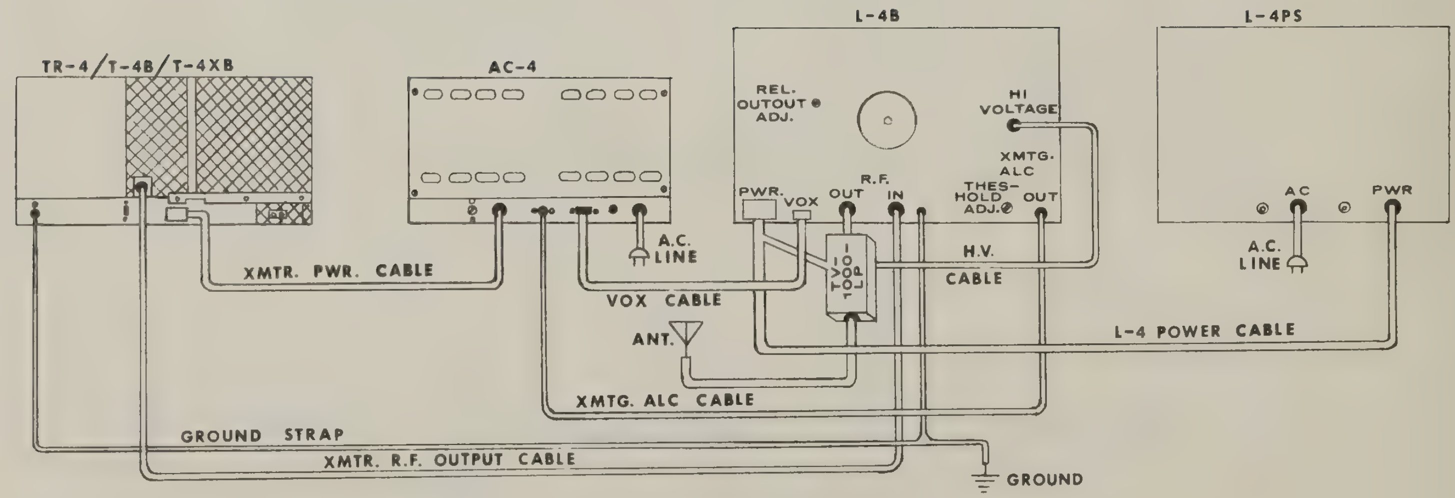
CONNECTING THE TR-4, AC-4 PWR. SUPPLY, AND MS-4 MATCHING SPKR.

FIGURE 2


TR-4
AC-4/MS-4 OR RV-4
Accessory contacts on a coax relay can be used for linear cut off bias switching.
LINEAR AMPLIFIER
TO MS-4
RF IN
RF OUT
ALC OUT
SPKR. CABLE
A.C. LINE
POWER CABLE
TRANSMITTING ALC
Coax Relays (Dow-Key DK60 G2 or equiv.) On most linears, these relays are built in.
ANT.
To Relay Supply Voltage
TO PIN 5
TO PIN 8

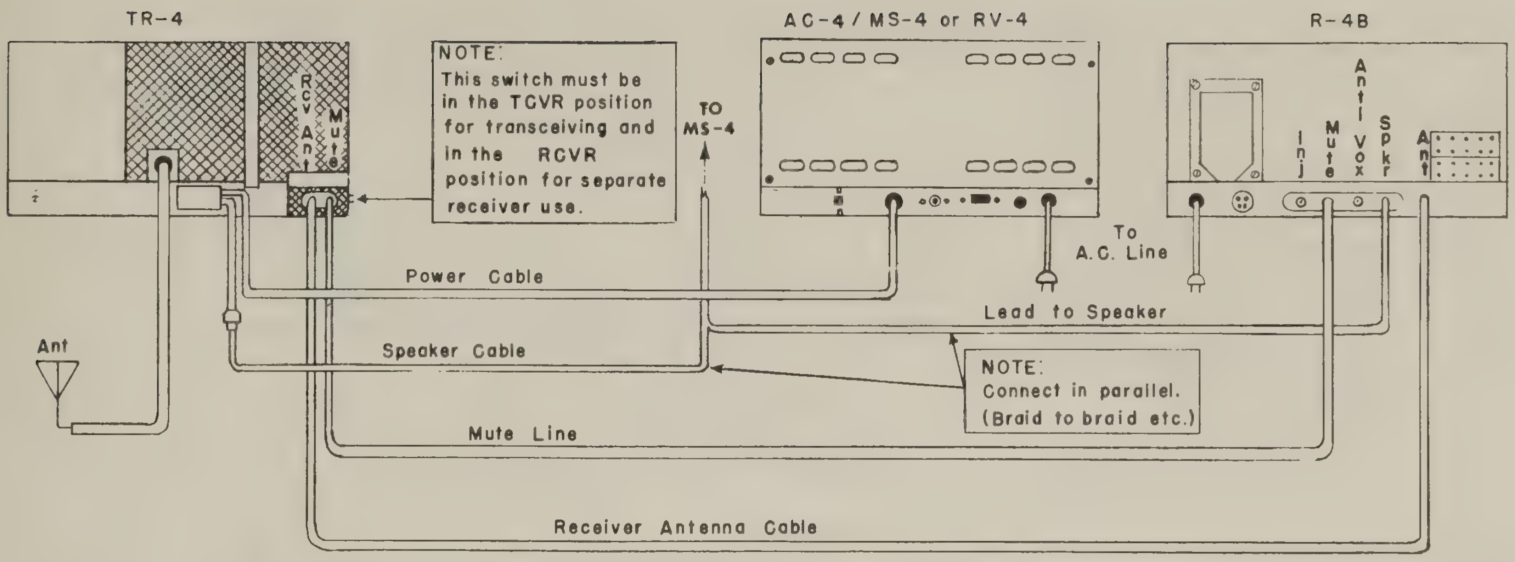
CONNECTING THE TR-4, AC-4, AND MS-4 TO A LINEAR AMPLIFIER

FIGURE 3



CONNECTING THE TR-4/T-4B/T-4XB AND AC-4 TO THE L-4 LINEAR AMPLIFIER

FIGURE 3.1



NOTE: This switch must be in the TCVR position for transceiving and in the RCVR position for separate receiver use.

NOTE: Connect in parallel. (Braid to braid etc.)

FIG. 4 USING THE TR-4 WITH AN EXTERNAL RECEIVER

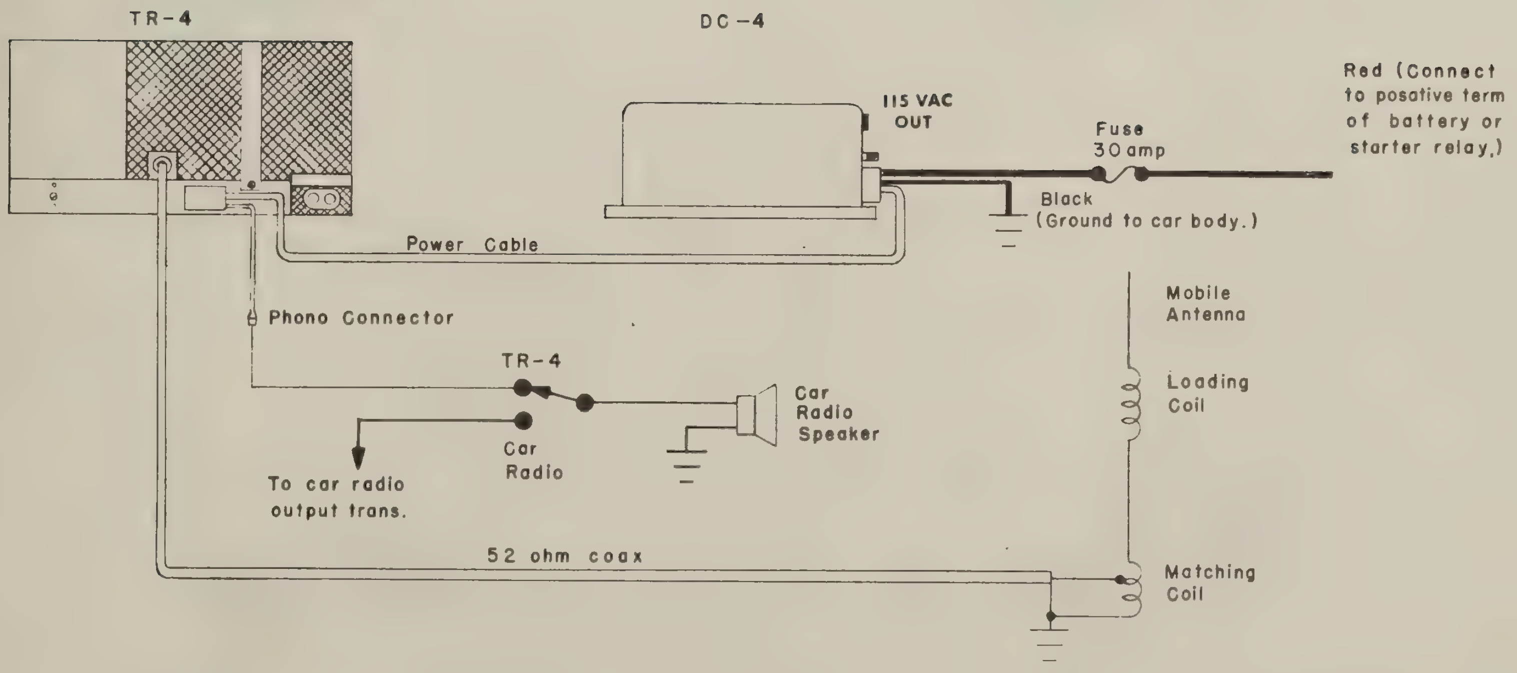


FIG. 5 ELECTRICAL CONNECTIONS FOR MOBILE INSTALLATION OF TR-4

Fig. 6 MECHANICAL DETAILS OF MOBILE INSTALLATION USING MMK-3 MOBILE MOUNTING KIT

Four threaded holes are provided in each side of the TR-4 top cover to accept wing bolts, and four punched holes are provided at the rear edge of the bottom cover for mounting of the tongue. (four 6-32 screws and nuts provided). The tongue holder can be mounted to the floor or transmission hump by drilling two 3/16-inch holes and fastening it down with the two #14 sheet metal screws provided. Note that two fibre washers are provided which must be positioned between the TR-4 case and the mounting bracket. These washers are not shown.

The mounting bracket may be attached to the dash either with the two #14 sheet metal screws or the 1/4-inch bolts and nuts (both sets provided). Additional holes may be drilled in bracket to match existing holes in the dash.

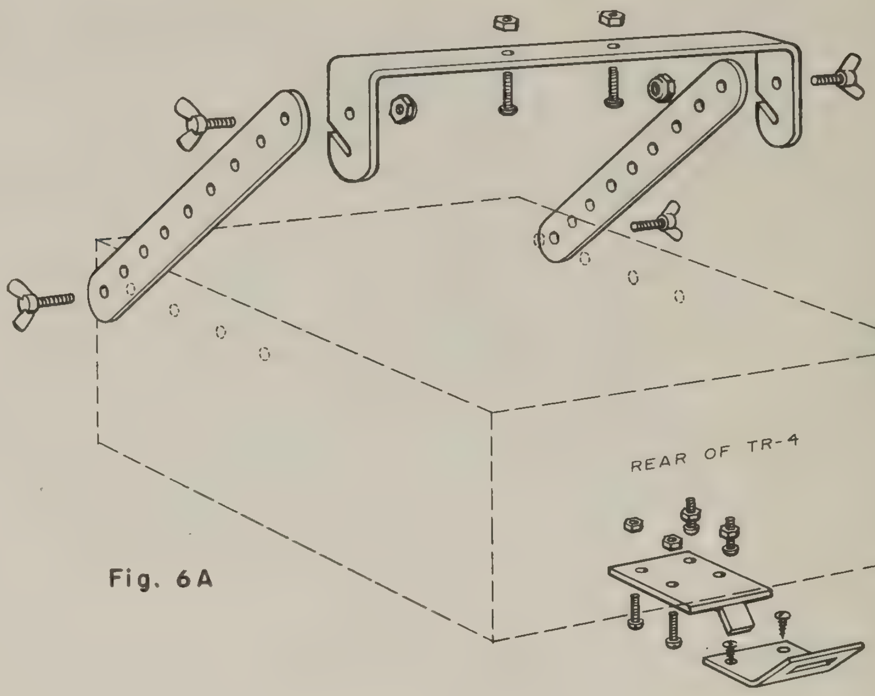


Fig. 6A

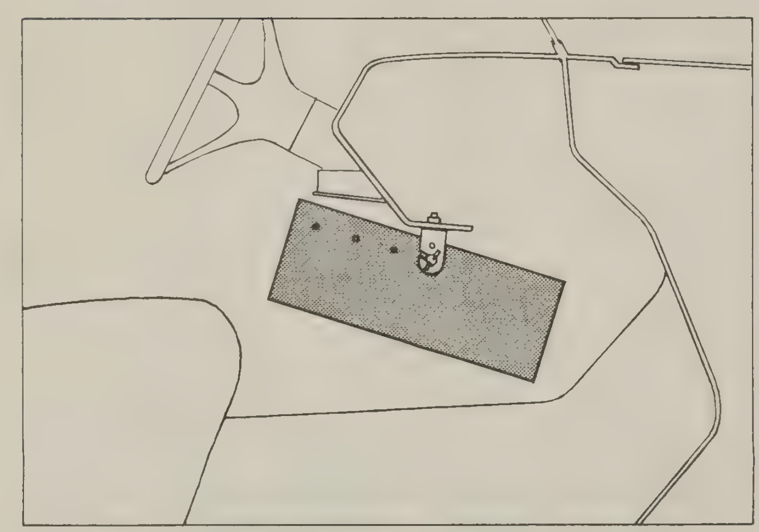


Fig. 6B

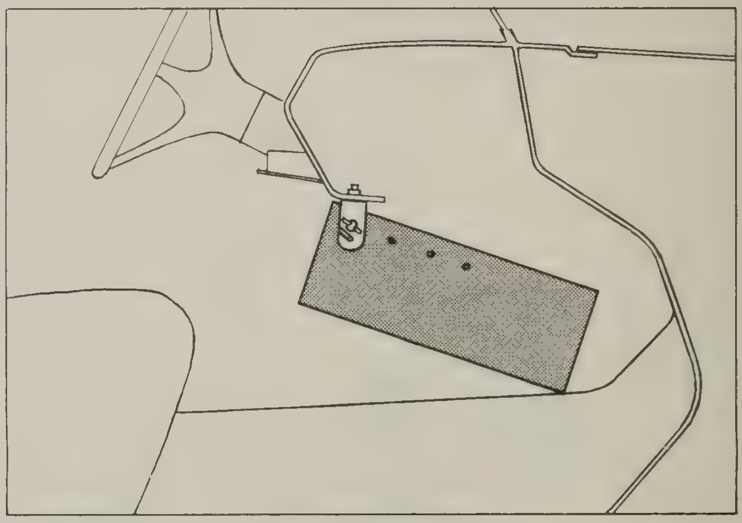


Fig. 6C

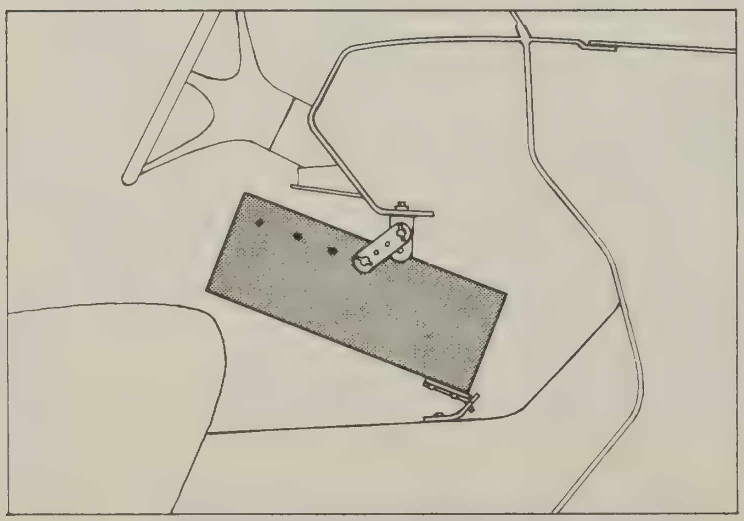


Fig. 6D

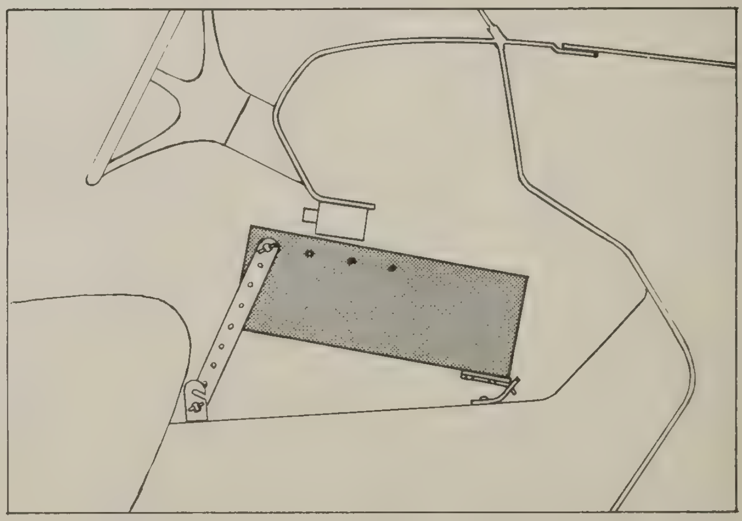
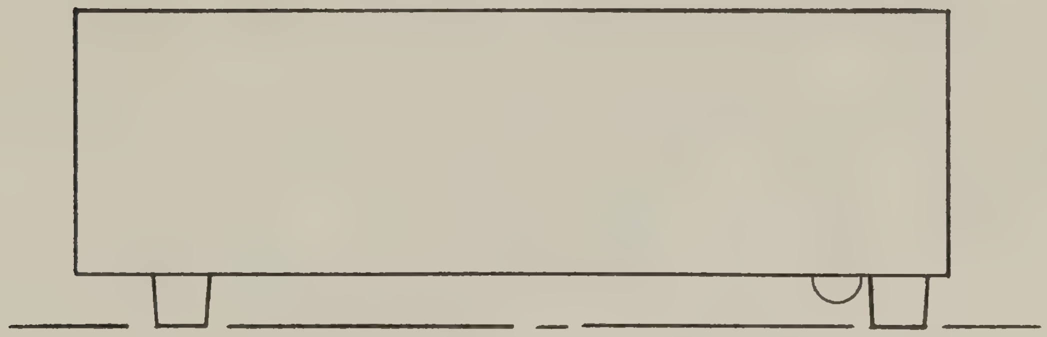


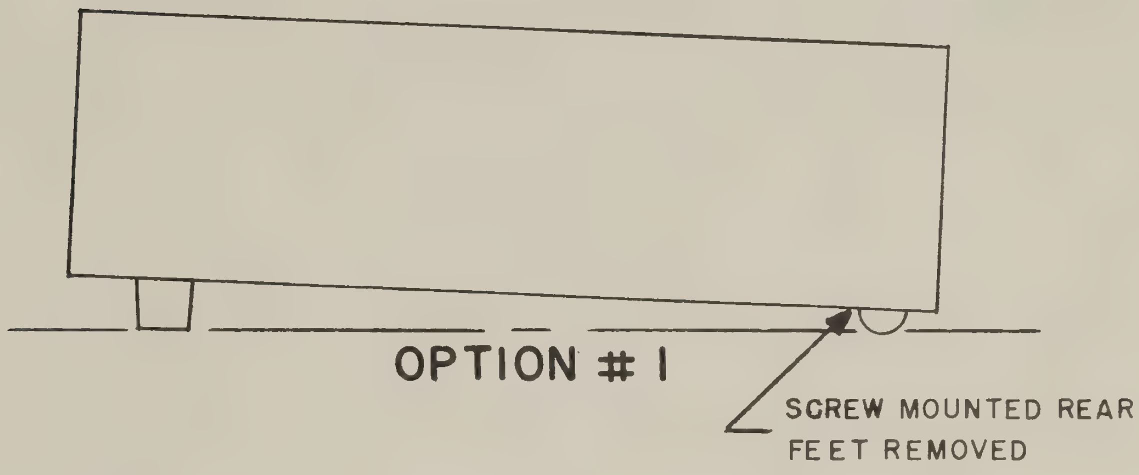
Fig. 6E

VIEWING ANGLE OPTIONS

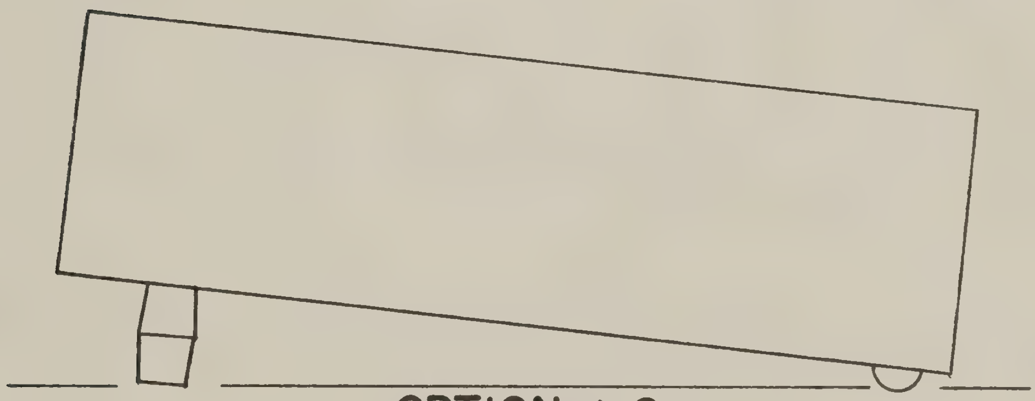
Fig. 7



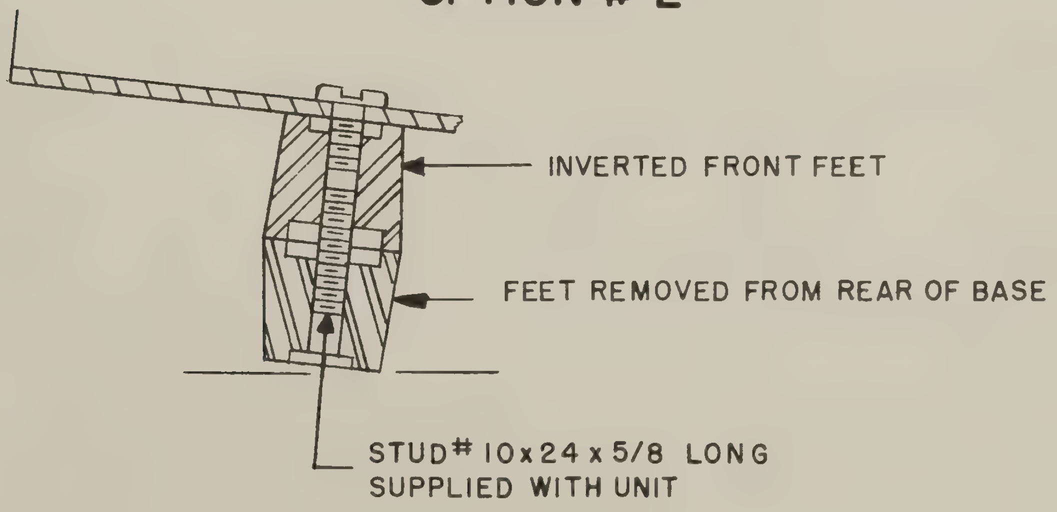
STANDARD



OPTION # 1



OPTION # 2



III. CONTROL FUNCTIONS

A. FRONT PANEL CONTROLS

1. MAIN TUNING - The Main Tuning knob of the TR-4 determines the frequency on which you transmit and receive. Each division around the calibrated skirt on this knob is equal to 1 kHz and each division on the Main Tuning dial is equal to 10 kHz. The small red knob just to the right of the dial scale is for adjusting the position of the indicator line for calibration. The knob skirt is also adjustable by pushing it in slightly and rotating it in the desired direction, while holding the Main Tuning knob stationary.

2. SIDEBAND - The SIDEBAND control selects either of two 2.1 kHz crystal filters for transmission and reception of upper and lower sidebands. Directly above this control are two indicator lights which show the sideband in use for a particular band. You will notice that one position of this switch is marked with an "X". This position must be used when operating AM or CW or when tuning up.

3. BAND - The BAND control is a seven position switch used to select the amateur band desired. You will notice that it has three 10 meter positions. Proceeding in a clockwise direction, the first covers 28.0 - 28.6 MHz, the second covers 28.5 - 29.1 MHz and the third covers 29.1 - 29.7 MHz.

4. RCVR GAIN - The RECEIVER GAIN control consists of two controls with concentric shafts. The lever controls the maximum RF gain of the receiver by varying the amount of negative bias applied to the grids of the AGC controlled tubes.

   The knob adjusts the audio gain by regulating the input to the grid of the audio power amplifier tube. The transceiver power switch is operated at the extreme counter clockwise end of rotation of this knob.

5. XMTR GAIN - The TRANSMITTER GAIN control regulates the microphone gain on AM and SSB. When the unit is operated on CW, it is used to adjust the RF drive to the proper level.

   This control is connected so that it regulates the VOX sensitivity as well as the audio drive to the balanced modulator. Since all changes in level due to the type microphone, how close or loud you talk, etc. effect equally the VOX and audio drive requirements, this eliminates the necessity of changing the VOX adjust control, located on the side of the TR-4 chassis, once it is set properly.

6. FUNCTION - The FUNCTION control is a four position switch which determines the mode of operation of the TR-4.

   In the SSB position, the receiver portion functions until the transmitter is energized either by talking into the microphone or pressing the Push-To-Talk switch. The transmitter then emits an upper or lower sideband signal depending on the setting of the SIDEBAND switch.

   In the CAL position, the 100 kHz crystal calibrator is switched on for calibration purposes. The receive and transmit functions operate the same as in the SSB position.

   In the X-CW position, the receiver portion functions until a key plugged into the key jack, is closed. It then goes into the transmit mode, a CW sidetone is energized, and the carrier is shifted approximately 1 kHz from the received frequency. It will remain on transmit during CW keying and will return to receive when keying is stopped briefly. Note that the SIDEBAND switch must be on the "X" position when operating X-CW or X-AM. Otherwise, no RF output will be obtained.

   It should also be noted that if the relays occasionally fail to close when the Function switch is placed in the X-CW position and the key, if used, is closed, the VOX GAIN control should be advanced until positive relay action is obtained.

   The X-CW position is also used for tuning up the transmitter. The key jack is a closed circuit type so it is not necessary to plug in a key for tune up.

   On the X-AM position, a controlled carrier screen modulator is incorporated for AM transmission, and a diode detector is incorporated for AM reception. Transmit receive switching is accomplished by VOX or PTT as on SSB.

7. RF TUNE - The RF TUNE control peaks the driver and RF amplifier grid and plate coils.

8. PLATE - The PLATE control tunes the power amplifier pi-network circuit to resonance by varying the input capacity.

9. LOAD - The LOAD control matches the impedance of the transceiver power amplifier to the impedance of the load by varying the output capacity of the pi-network circuit.

10. S-METER - The S-METER indicates relative signal strength of the received signal. It is calibrated in S-units from S-1 to S-9 and in dB over S-9. Each S-unit equals approximately 5 dB and S-9 equals about 30 Microvolts.

10. S-METER - (Continued) - On transmit, it indicates the point at which the transmitting AGC starts to help in setting the proper level of the XMTR GAIN control.

11. PLATE AMPERES - The PLATE AMPERES meter indicates plate current in the final amplifier tubes, and relative RF output.

12. OUTPUT METER CONTROL - This control consists of a push switch and potentiometer. Pushing in converts meter from Plate Amperes to a Relative Output indicator and rotating varies the sensitivity of this indicator.

13. BLANKER - The BLANKER control is a two position switch which turns on the Accessory, 34-PNB Noise Blanker. Low level signals, masked by noise impulses without the noise blanker, can be copied when the blanker is turned on.

    In most situations, it is desirable to leave the blanker on continuously. However, it may happen you are copying an extremely weak signal under no noise conditions. In this case, it may be advantageous to turn the blanker off since occasional peaks of atmospheric noise may trigger the blanker and generate additional noise.

B. SIDE CONTROLS AND JACKS (Front to rear)

1. PHONES - The headphone jack automatically disconnects the speaker when headphones are plugged in. The audio output impedance at the jack is 4 Ohms.

   (We recommend headphones having an impedance of approximately 500 Ohms.) (A speaker may be plugged in here instead of connecting it to the power connector if desired.) A Switchcraft Type 229 plug (red) is supplied with the TR-4 which can be used either here or at the KEY jack.

2. MIC - This is a .210 inch diameter phone jack of the three conductor variety to accommodate microphones with push-to-talk switches. It requires a Switchcraft Type S-230 plug which is supplied with your TR-4.

3. VOX - The VOX control adjusts the gain of the VOX amplifier and relay release time on CW.

4. ANTI-VOX - The ANTI-VOX control adjusts the sensitivity of the ANTI VOX amplifier.

5. ZERO - The S-Meter ZERO control is for adjusting the no signal reading of the S-Meter to S-1.

6. KEY - The KEY jack is of the normally closed variety. Note that plugging a key into this jack will disable the transmitter on all modes of operation and the receiver on AM unless the key is closed.

C. REAR CONTROLS & JACKS

1. LIGHTS - The LIGHTS control is a two position slide switch which is used to control the brilliance of the dial lights. The letters D and B indicate dim and bright respectively.

2. CARRIER BALANCE - The CARRIER BALANCE control is a potentiometer located on top of the chassis along the rear edge and is for balancing the balanced modulator. Note that this control has a planetary drive and requires 10-1/4 turns for complete travel.

3. SIDETONE - The SIDETONE control, located on the rear of the chassis, controls the volume of the CW sidetone with respect to the received signal. If no sidetone is desired, rotate the SIDETONE control fully counter clockwise.

4. RCVR MUTE - The RECEIVER MUTE jack provides a means of muting an external receiver without an external relay. It provides DC path to ground on receive and may be used with Drake 1-A, 2-A, 2-B, 2-C, R-4, R-4A, R-4B and SPR-4 Receivers.

5. RCVR ANT - The RECEIVER ANTENNA jack provides a means of connecting the antenna to an external receiver without an external relay.

6. ANTENNA - An SO-239 connector connects the TR-4 to the station antenna system.

D. OTHER

1. TCVR/RCVR - The TRANSCEIVER/RECEIVER switch selects between normal transceive and reception with an external receiver. It is located on the left side of the chassis.

2. PTO - (Permeability Tuned Oscillator) indicator lamp (mounted directly above the Main Tuning knob) and lights only while the TR-4 PTO is functioning. For example, when using an RV-4 with its Function switch in "RCV" and transmitting with the TR-4, the TR-4 indicator lamp lights. When the transmission has ended, the TR-4 lamp goes out. If the RV-4 used has an indicator lamp, it lights whenever the TR-4 lamp does not.

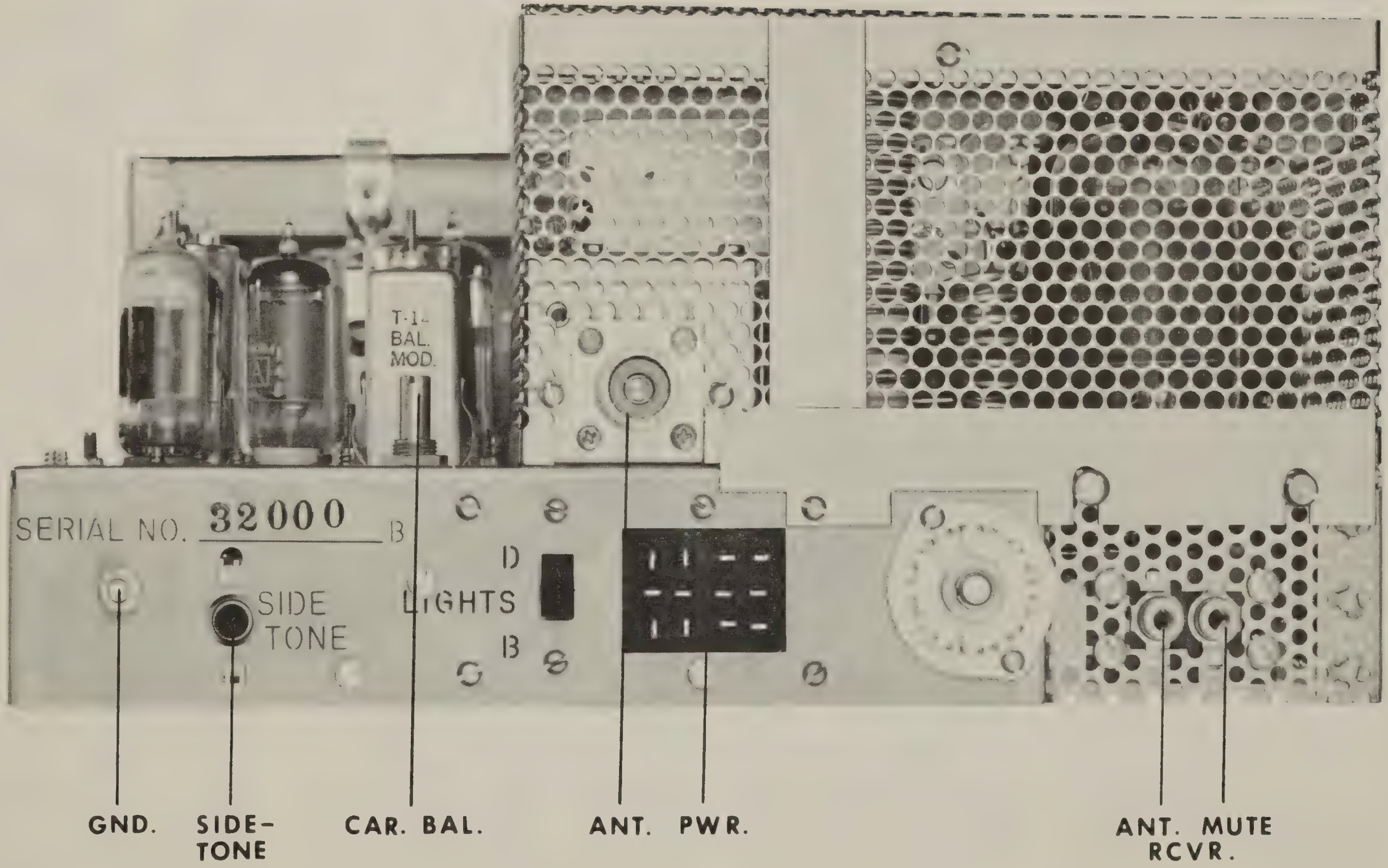


FIGURE 8. REAR VIEW OF TR-4 TRANSCEIVER

IV. TUNING PROCEDURE

WARNING: UNDER NO CIRCUMSTANCES SHOULD OPERATION OF THE TR-4 BE ATTEMPTED UNLESS IT IS CONNECTED TO A PROPER ANTENNA OR A DUMMY LOAD OF SUFFICIENT POWER HANDLING CAPACITY!

A. BIAS ADJUSTMENT

Before any type operation is attempted, it will be necessary to set the power supply bias adjustment as described here.

1. Turn on TR-4 by rotating RCVR GAIN control knob clockwise.
2. Rotate XMTR GAIN control fully counter clockwise.
3. Turn SIDEBAND switch to the counter clockwise position.
4. Turn FUNCTION switch to X-CW.
5. Adjust AC-4 or DC-4 BIAS adjustment for a reading of .1 on the Plate Amperes meter. This completes the adjustment.

B. ADJUSTING DIAL CALIBRATION

The calibration of the Main Tuning dial on the TR-4 may vary slightly from band to band due to the tolerance limits of the various crystals. Therefore, the Main Tuning dial index has been made adjustable by means of the small red knob to its right. To set the calibration on a given band, proceed as follows:

1. Set XMTR GAIN fully counter clockwise.
2. Set FUNCTION switch to CAL.
3. Set BAND SWITCH to desired band.
4. Peak RF TUNE for maximum noise.
5. Zero beat the 100 kHz calibrator signal nearest the desired operating frequency.
6. Slide the red knob to the right of the dial scale until the index line coincides with the 100 kHz dial calibration.
7. While holding the Main Tuning knob, push in on its calibrated skirt and rotate it until the arrow coincides with the indicator line.

C. TUNE-UP ON THE DESIRED BAND

WARNING: DO NOT ALLOW THE PLATE CURRENT TO EXCEED .1 AMPS FOR MORE THAN 5 OR 6 SECONDS IF THE PLATE CONTROL IS NOT TUNED FOR PLATE CURRENT DIP OR MAXIMUM RF OUTPUT. Failure to observe this warning will result in rapid final amplifier tube deterioration due to excessive plate dissipation.

NOTE: The final amplifier pi-network will match a 50 Ohm load with VSWR no higher than 2:1 except on 80 meters where a lower VSWR will be required. Here it may be found necessary to use an external "match box" or change the feed line by 1/8 to 1/4 wave length to get the proper match.

C. TUNE-UP ON THE DESIRED BAND (Continued)

Preset the controls as follows:

1. BAND SWITCH to desired band.
2. FREQUENCY knob to a frequency inside the amateur band in use.
3. XMTR GAIN fully counter clockwise.
4. LOAD fully counter clockwise.
5. SIDEBAND in the "X" position.
6. FUNCTION switch on SSB.
7. RF TUNE - temporarily peaked on received noise.

Rotate the FUNCTION switch to the X-CW position and advance the XMTR GAIN control clockwise until the Plate Amperes meter moves up scale slightly from idling current. (If plate current is high even with XMTR GAIN fully counter clockwise, reduce it to idling by adjusting CARRIER BALANCE control, see "IV, Section D"). Peak the RF TUNE control for maximum plate current and quickly tune the PLATE control for a dip in plate current. When the dip is found, rotate the XMTR GAIN clockwise until the plate current no longer increases.

Depress the OUTPUT METER control and rotate it for a significant indication on the Plate Amperes meter. (This control converts the Plate Amperes meter to a Relative Output indicator and varies its sensitivity.)

Alternately adjust LOAD and PLATE controls in small increments for maximum RF output. If meter goes off scale during this process, simply reduce the sensitivity by turning the Output Meter control clockwise.

Now, release the OUTPUT METER control and adjust PLATE control slightly for plate current dip. At this point, the plate current should read between .380 and .500 Amps depending upon line voltage, antenna match, drive, tube condition, et cetera. Do not attempt to increase the LOAD control beyond the point at which maximum RF output occurs. This will result in excessive plate dissipation.

It should not be necessary to advance the LOAD control beyond 4-1/2 to obtain maximum RF output. Further advancement indicates that the SWR of the antenna system is too high and leaving the control set beyond this point is likely to result in excessive harmonic radiation.

The above procedure should be completed as quickly as possible and the FUNCTION switch should be returned to the SSB position.

Notice that when the FUNCTION switch is in the X-CW position, the screen voltage on the final amplifier tubes is reduced to prevent overheating. When the switch is on SSB, this voltage is increased so that a peak power input of 300 Watts can be obtained.

D. ADJUSTMENT OF CARRIER BALANCE CONTROL

The CARRIER BALANCE control is factory adjusted and should require a minimum of resetting under most conditions. However, it should be checked before the TR-4 is operated on SSB.

After tuning up the TR-4 as described in "IV, Section C", set the SIDEBAND switch to X, the XMTR GAIN fully counter clockwise, and the FUNCTION switch to X-CW. Now depress OUTPUT METER control and adjust the CARRIER BALANCE control (located on top of the chassis near the rear edge), for zero RF output. (If output cannot be reduced to zero, adjustment of the carrier balance capacitor may be necessary. See VIII). Return the FUNCTION switch to SSB. This completes the adjustment.

The carrier suppression provided by the crystal filters on SSB is sufficiently great that it will be impossible to adjust the balanced modulator for optimum attenuation in this mode unless a sensitive RF detector (receiver) is used in close proximity to the transceiver. We therefore recommend that balanced modulator adjustment be performed in the CW mode since the filters are not effective here. The balanced modulator should be adjusted after the unit has warmed up about 1/2 hour in order to maintain optimum balance over a prolonged period of time.

Some residual signal will occasionally be observed on the CW mode when the XMTR GAIN control is set at minimum. This is of no consequence since the additional attenuation provided on SSB will provide the desired carrier suppression.

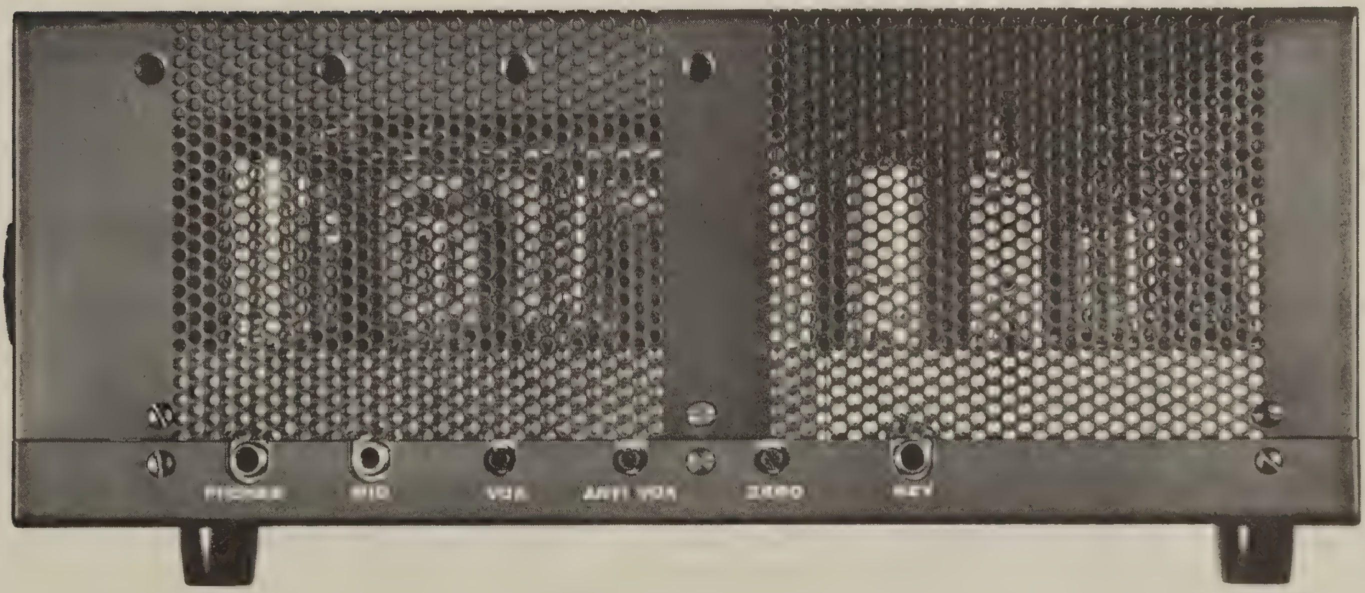


FIGURE 9. SIDE VIEW OF TR-4 TRANSCEIVER

V. OPERATION

In the following discussion, it is assumed that the TR-4 has already been tuned up on the desired band as described under "Tuning Procedure", Section IV.

A. VOICE CONTROLLED OPERATION ON SSB

Preset the controls as follows:

SIDEBAND - On desired sideband as shown by indicator lights.
FUNCTION - On SSB.
XMTR GAIN - Fully counter clockwise.
RF GAIN - Fully clockwise.
AF GAIN - Fully counter clockwise (do not turn off power).
VOX GAIN - Fully clockwise.
ANTI VOX - Fully counter clockwise.

While talking into the microphone in a normal voice, increase the XMTR GAIN control until the S-meter starts kicking up scale above its resting value. (With no modulation, the S-meter will rest up scale on transmit). This indicates that the transmitting AGC is starting to work and the transmitter is peaking at maximum output. Continue talking and reduce the VOX GAIN until a point is reached where further reduction results in too frequent relay drop out.

Now increase the AF GAIN until received signals are of the desired volume. This may cause the transceiver to cycle back and forth between transmit and receive. Adjust the ANTI VOX control until the cycling stops. You are now ready to operate.

B. PUSH TO TALK OPERATION ON SSB

If the PUSH TO TALK switch on your microphone is properly connected as described under "Installation Instructions", Section II, Part D, it may be depressed at any time, thus over-riding the VOX system.

If you do not desire the VOX to function at all, turn the VOX adjust control fully counter clockwise.

REMEMBER: On SSB, the TR-4 transmits on exactly the same frequency on which it receives. Therefore, be sure that before you answer another station's CQ, or break another QSO, you have the signals tuned in so that the voices sound normal. Otherwise, you will not be transmitting exactly on frequency.

NOTE: If a key is used, it must either be closed or unplugged from the key jack for SSB and AM operation.

C. CW OPERATION

To work CW, plug your key into the KEY jack. If an electronic keyer is used, connect it for grid block keying. Leave the key in the open condition.

Note that the TR-4 uses shifted carrier CW. With this system, it is possible to transmit approximately on the received station's frequency without being zero beat while receiving. The receiver BFO is shifted from the transmitted signal frequency about 1 kHz.

To receive CW signals, place the FUNCTION switch on the X-CW position and the SIDEBAND switch in the X position. Tune in a CW signal for an audio pitch of about 1 kHz and adjust the audio gain control for pleasing volume.

To transmit, depress the key, and rotate the XMTR GAIN control clockwise just below the point at which plate current no longer increases. DO NOT ADVANCE IT BEYOND THIS POINT.

Advance the SIDETONE control on the rear of the chassis until the sidetone reaches the desired volume. (Adjusting the RCVR GAIN knob will regulate both the received signal and sidetone volume.)

The TR-4 uses automatic transmit receive switching. This means that it will automatically transmit when the key is depressed and will remain in the transmit condition through keying. It will return to the receive condition when the key is released for a brief period. If this period is too long, decrease the VOX control setting to minimum.

Manual transmit/receive switching can be accomplished by connecting an external switch (i.e. foot switch) to the push to talk circuit of the MIC jack.

D. AM OPERATION

For AM operation, the FUNCTION switch should be in the X-AM position and the SIDEBAND switch should be in the X position. If a key is used, it should be left closed or unplugged.

Tune in AM signals for most pleasing audio. This will not necessarily coincide with maximum S-meter reading.

The same procedure should be followed in setting the various gain controls for VOX operation on AM as for SSB, except that the XMTR GAIN should be adjusted for plate current peaks of from .2 to .25 Amps when talking into the microphone in a normal voice. Care should be taken to stay within these limits since the transmitting AGC does not work on AM.

D. AM OPERATION (Continued)

The TR-4 uses a controlled carrier screen modulator which holds the unmodulated carrier input power to a few watts but allows 260 Watts PEP input on voice peaks. This system is compatible with SSB linear amplifiers. Due to the low duty cycle of this type AM, a linear can be run with the same PEP input as it can on SSB.

If AM reception, using product detection is desired, it will be necessary to switch the FUNCTION switch to the SSB position for receiving and back to X-AM for transmitting.

E. GENERAL PRECAUTIONS FOR OPERATION NEAR BAND EDGE

If you intend to operate near the edge of the band, be sure that you check the dial calibration as described under tuning procedure. When working SSB be sure you are using the sideband that will be inside the band i.e. lower on the high edge or upper on the low edge. On AM or CW, the transmitted carrier will be 1 kHz higher or lower than the indicated dial frequency depending upon whether the upper or lower sideband indicator light is lit.

F. OPERATION WITH LINEAR AMPLIFIERS

The TR-4 Transceiver is conservatively rated at 300 Watts PEP input. It is doubtful if it would be worthwhile to use a linear with a power rating of less than 1000 to 2000 Watts PEP input. A triode type grounded grid linear of 1000 to 2000 Watt PEP rating will present a satisfactory load for the TR-4.

If your particular linear is of the grounded cathode type with high impedance input, it will be necessary to install a resistive pad between the TR-4 and the linear that will present the proper impedance to the TR-4. Such a pad must be made of non-inductive resistors and must have adequate power handling capacity to prevent it from being destroyed when the TR-4 is turned on. Antenna switching should be accomplished as shown in Figure 2. Many linears have these relays built in.

In order to properly operate the TR-4 with a linear, proceed as follows:

1. With the TR-4 connected to the linear, tune the RF TUNE control as described under Section IV, "TUNING PROCEDURE".
2. Set the LOAD control to the setting indicated on the chart below, for the band desired, when using a linear with a 50 Ohm input.
3. Tune the PLATE control for minimum plate current.
4. Switch the FUNCTION switch to the desired mode of operation.
5. Advance the XMTR GAIN control until the desired amount of input to the linear amplifier is obtained.

Note that when the TR-4 is loaded much below maximum RF output the ALC does not function properly and flat topping in the TR-4 may result. Care

FIGURE 12. RESISTANCE CHART

Ident No.	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	9.5K	2.5Meg	20K	0	Fil	9.6K	220	220	150K
V2	12AV6	3.3Meg	Inf.	Fil	0	150K	150K	350K	---	---
V3	6EA8	8.0K	150K	250K	Fil	0	11K	2.2K	1K	34K
V4	6EJ7	25K	660K	23K	Fil	0	0	11K	9.5K	0
V5	6BZ6	1Meg	1K	Fil	0	350K	125K	1K	---	---
V6	12BY7A	25K	67K	0	0	0	Fil	8.5K	25K	0
V7	12BA6	2.8Meg	0	Fil	0	11K	10K	100	---	---
V8	6JB6	8.2K	40K	23K	Fil	Fil	40K	8.2K	0	23K
V9	6JB6	8.2K	40K	23K	Fil	Fil	40K	8.2K	0	23K
V10	6JB6	8.2K	40K	23K	Fil	Fil	40K	8.2K	0	23K
V11	6BZ6	2.5Meg	150	0	Fil	10K	13K	0	---	---
V12	12BA6	2.5Meg	0	Fil	0	10K	13K	68	---	---
V13	12AX7	1Meg	22K	45K	0	0	2.2Meg	55K	48K	Fil
V14	13DE7	8K	2.5Meg	2.5Meg	Fil	0	2.2Meg	22Meg	0	Inf
V15	12BA6	2Meg	0	0	Fil	10K	13K	25K	---	---
V16	6GX6	2.2Meg	1K	0	Fil	250K	9.2K	22K	---	---
V17	6AQ5	500K	270	0	Fil	8.7K	8K	500K	---	---
V18	12AX7	350K	6.8Meg	0	0	Fil	350K	500K	3.3K	N.C.
V19	6EV7	13K	4.5Meg	0	Fil	0	110K	450K	820	1.5Meg
V20	OA2	7.8K	0	Inf	0	7.8	Inf	0	---	---

Identification Number	Transistor Type	Measured At:		
		Emitter	Base	Collector
Q1	2N5950	Located in PTO		
Q2	2N3563	Located in PTO		
Q3	AT5059	0	5.6K	43K
Q4	2N3394	0	750	1.1K
Q5	2N3877	1K	56K	6.8K

NOTE:

All measurements were made from ground with the power supply disconnected from the TR-4. The BAND switch was on 40 meters, the FUNCTION switch was on CAL, and the RCVR GAIN and XMIT GAIN controls were fully clockwise. The VOX, ANTI VOX and SIDETONE controls were fully clockwise, and the ZERO control was set at the balance point. The accessory 34-PNB jumper plug was in the noise blanker jack.

FIGURE 13.

VOLTAGE CHART

Ident. No.	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V 1	6EA8	122	-2	125	0	6.3*	250 245	2.6	2.6	-1.3
V2	12AV6	0 -1.6	13.0 0	12.6*	0	0 0.9	0 0.9	255 122	---	---
V3	6EA8	155 150	0	98 150	6.3*	0	260 250	3.5 150	17 15.5	17 15.2
V4	6EJ7	155 2.8	0	NC	6.3*	0	0	270 230	175 145	---
V5	6BZ6	-42 0	0.9 23	12.6*	6.3*	70 140	58 144	0.9 23	---	---
V6	12BY7A	155 3.3	0	NC	0	0	6.3*	265 240	262 165	0
V7	12BA6	-.14	0	12.6*	0	235 230	98 110	1.25 150	---	---
V8	6JB6	262 250	-60	155 1.0	6.3*	12.6*	-60	262 250	0	155 0.4
V9	6JB6	262 250	-60	155 1.0	6.3*	12.6*	-60	262 250	0	155 0.4
V10	6JB6	262 250	-60	155 1.0	6.3*	12.6*	-60	262 250	0	155 0.4
V11	6BZ6	-.16	1.6 150	0	6.3*	235	125 150	0	---	---
V12	12BA6	-.16	0	12.6*	0	240	105 150	1.1 150	---	---
V13	12AX7	-.1 0	-61 -61	-59 -59	0	0	-.16	-61 -61	-59 -58	6.3*
V14	13DE7	260 250	11.4 11.2	11.4 11.2	12.6*	0	11.4 11.2	-1.0 -1.0	0	64 53
V15	12BA6	0	0	0	12.6*	248 140	155 144	155 1.3	---	---
V16	6GX6	-6.0 -5.6	4.0	0	6.3*	140 140	140	0	---	---
V17	6AQ5	NC	7.2 6.8	0	6.3*	240 230	155 150	0	---	---
V18	12AX7	88 87	-.75	0	0	12.6*	130 125	0	1.23 1.1	NC
V19	6EV7	260 180	-6 -.36	0	6.3*	0	103 110	0	1.25 1.20	TP
V20	OA2	146	NC	NC	NC	NC	NC	0	---	---

FIGURE 13. (Continued)

Identification Number	Transistor Type	Measured At:		
		Emitter	Base	Collector
Q1	2N5950	Located	in PTO	
Q2	2N3563	Located	in PTO	
Q3	AT5059	0	0	61
Q4	2N3394	0	11.2	0
Q5	2N3877	2.3	2.8	48

NOTE:

All measurements were made with an 11 Megohm VTVM and were taken from ground. RF TUNE, PLATE and LOAD controls were set as described under Section IV, "TUNING PROCEDURE". BAND switch was on 40 meters, MAIN TUNING was at 7.250 MHz and SIDEBAND was on "X". Receive measurements were made with the FUNCTION switch in the CAL position and transmit measurements were made with the FUNCTION switch in the X-CW position, with the following exception:

On V14, both receive and transmit measurements were made with the FUNCTION switch in the X-AM position and with the PTT grounded for transmit.

The AC-4 Power Supply was used. Where two voltages are shown, the top is for receive and the bottom is for transmit. An "*" indicates AC voltage. The accessory 34-PNB jumper plug was in the noise blanker jack.

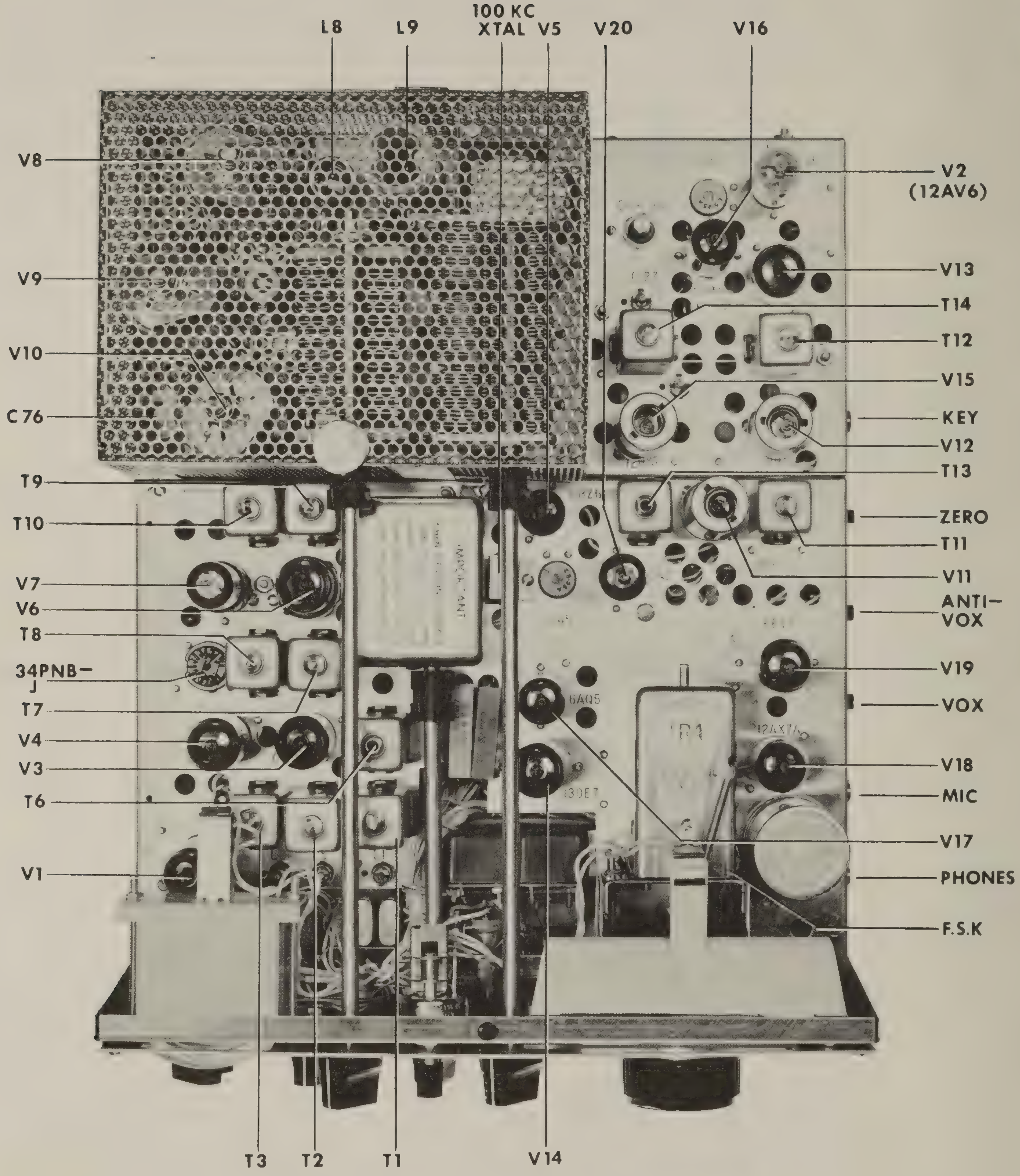


FIGURE 14. TOP VIEW

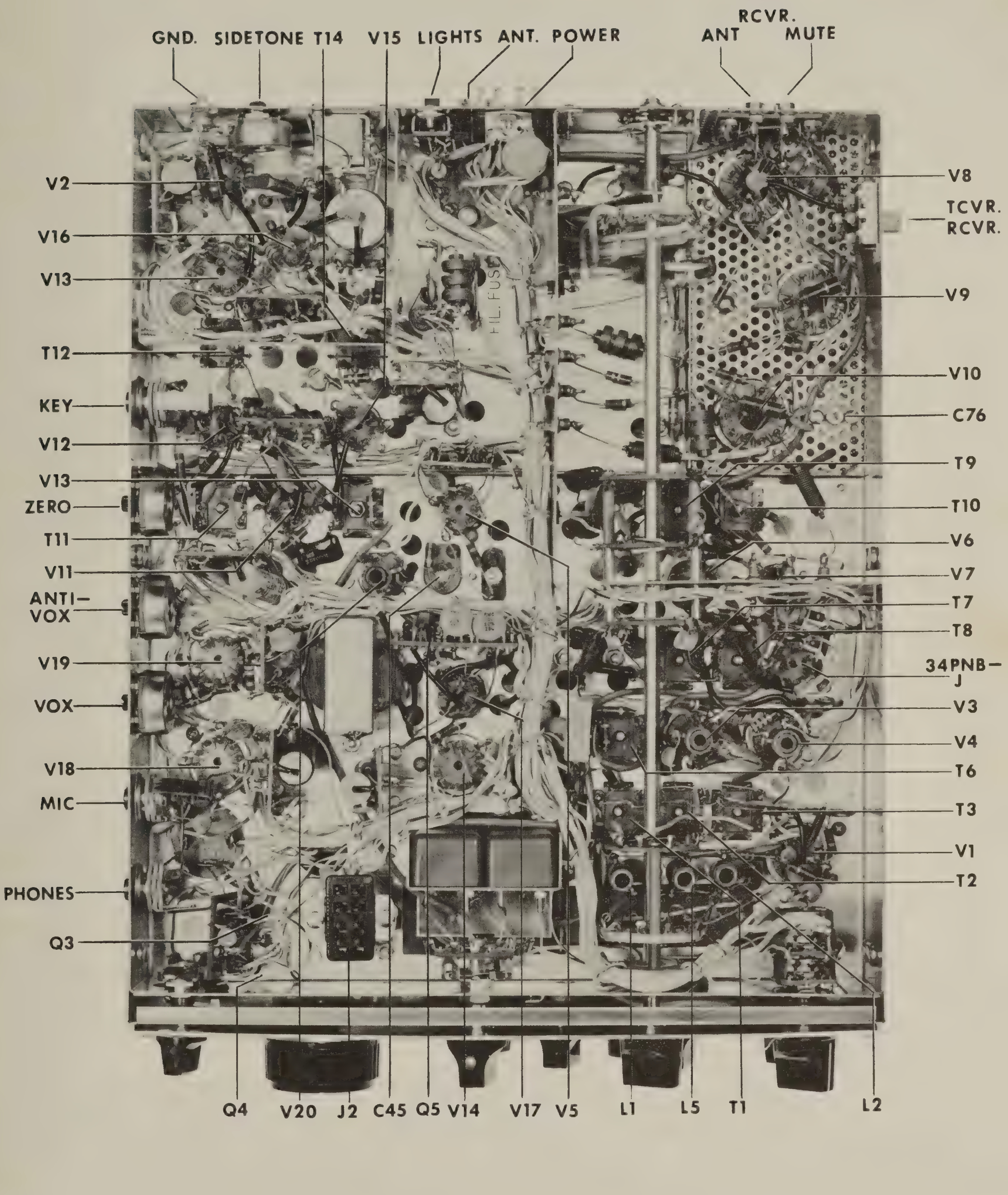


FIGURE 15. BOTTOM VIEW

VIII. ALIGNMENT INSTRUCTIONS

Alignment of the TR-4 will require the following equipment:

1. A general coverage receiver capable of receiving WWV.
2. An 11 Megohm VTVM.
3. An alignment load consisting of a 1000 Ohm non inductive resistor (1/2 Watt will do), in series with a .005 uuF disc ceramic capacitor. Small alligator clips connected to each end of this arrangement would be a great help.
4. A 52 Ohm dummy load of sufficient power handling capacity. (Heathkit Cantenna).

Before alignment is attempted, the plate and screen power leads of the final amplifier tubes should be disconnected where they pass through the partition under the chassis.

> BE SURE THE POWER IS DISCONNECTED BEFORE THIS IS ATTEMPTED, OR SERIOUS ELECTRICAL SHOCK WILL RESULT.

A. CRYSTAL CALIBRATOR ALIGNMENT

1. Connect power, turn on transceiver and let warm up 30 minutes.
2. Preset the XMTR GAIN control fully counter clockwise.
3. Set FUNCTION switch to CAL.
4. Tune in WWV on the general coverage receiver with the BFO off.
5. Connect a wire from the receiver antenna terminal to V5 of the TR-4. Wrap the wire around the tube a turn or two.
6. Adjust C-45, located on top of the TR-4 chassis, until the calibrator signal is zero beat with the unmodulated WWV carrier.

B. ADJUSTMENT OF 9.0 MHz OSCILLATOR

1. Make sure that the TR-4 has had a chance to warm up for 30 minutes.
2. Set the FUNCTION switch in the SSB position.
3. Turn up the AUDIO GAIN control until noise is easily audible in the speaker.
4. While switching the SIDEBAND knob back and forth, adjust C-130, located on top of the chassis near the rear edge, until the pitch of the noise is the same on both positions.

C. CRYSTAL OSCILLATOR ALIGNMENT

1. Set the VTVM to its lowest DC negative volt scale and set pointer to about center scale with VTVM zero adjust control.
2. Connect the common lead of the VTVM to the TR-4 chassis and the DC lead to test point at V-1.
3. Set band switch to 40 meters and adjust L-1 for maximum negative DC voltage.
4. Switch to 15 meters and adjust L-5 for maximum as in Step 3.
5. Switch to 10_3 (fully clockwise) and adjust L-2 for maximum as in Steps 3 and 4.
6. The 10_1 and 10_2 bands should read about the same negative voltage as 10_3.

D. VFO ADJUSTMENT

The permeability tuned VFO was carefully adjusted at the factory and should require no further alignment. If it does not appear to track from one end of its range to the other, it should be returned to our plant for realignment. Maximum calibration error is 1 kHz when calibrated to the nearest 100 kHz point.

If you notice the same error from one end of the band to the other, and you cannot correct it with the movable dial index, the main dial may be slipped on its shaft enough to bring the corrector back into range.

E. ADJUSTMENT OF INJECTION COUPLERS

1. Tune in crystal calibrator signal at 7.3 MHz (BAND switch on 40 meters).
2. Place alignement load from Pin 6 of V-1b to ground and adjust T-3 top for maximum S-meter reading.
3. Move load to Pin 9 of V-3a and adjust T-3 bottom for maximum.
4. Move BAND switch to 15 meters and repeat the procedure for T-2.
5. Move BAND switch to the center 10 meter band and repeat the above procedure for T-1. Note: On T-1, adjust the bottom slug when the load is on Pin 6 of V-1b and the top slug when the load is on Pin 6 of V-3a.

F. RECEIVING IF ALIGNMENT

1. Peak RF TUNE control on noise at 3.8 MHz.
2. Adjust T-11 top and bottom and T-12 top and bottom for maximum noise from the speaker.

G. ADJUSTMENT OF BALANCED MODULATOR

1. Disconnect power and reconnect the screen and plate supply leads to the final amplifier tubes.
2. Reconnect power.
3. Connect dummy load to antenna jack (J-4).

NO ATTEMPT SHOULD BE MADE TO OPERATE THE TR-4 ON TRANSMIT UNLESS IT IS CONNECTED TO AN ADEQUATE LOAD. TO DO SO COULD RESULT IN SERIOUS DAMAGE.

4. Peak RF TUNE for maximum receiver sensitivity.
5. With XMIT GAIN fully counter clockwise, place FUNCTION switch in X-CW position and SIDEBAND switch in "X" position.
6. If plate current exceeds 0.15 Amp, rotate RF TUNE until 0.15 Amp is observed.
7. If plate current is less than 0.15 Amp, rotate CARRIER BALANCE pot until plate current reaches 0.15 Amp.

IN THE NEXT STEP, PREVENT PLATE CURRENT FROM RISING ABOVE 0.15 AMP BY DETUNING "RF TUNE".

8. Peak T-14 for maximum plate current.
9. Null CARRIER BALANCE pot (and C-127 if necessary) for minimum plate current. When properly set, there will be no difference in plate current between "X" and non "X" SIDEBAND switch positions.

H. FILTER MATCHING TRANSFORMERS

1. Adjust S-METER ZERO pot for zero S-meter deflection (S-1).
2. With SIDEBAND switch in USB, tune in the calibrator signal at 4.0 MHz for maximum S-meter reading.
3. Turn RF TUNE control until S-meter reads exactly S-5.
4. Turn the MAIN TUNING control clockwise to increase the audio frequency until the S-meter drops to S-3.
5. Adjust T-6 and T-13 for maximum S-meter reading.
6. Repeat Steps 2 through 5 for best results.
7. Center 9.0 MHz oscillator as described in Paragraph B, Section VIII.

I. CARRIER BALANCE ADJUSTMENTS

1. Turn the XMTR GAIN control fully counter clockwise, set the SIDEBAND switch to "X" and turn the FUNCTION switch to "X-CW".
2. Adjust the CARRIER BALANCE control for minimum plate current and RF output.

3. Now adjust the slug tuned capacitor (C-127) for further null.
4. Alternately adjust these two controls until no further null can be obtained.
5. Return the FUNCTION switch to the SSB position.
6. An external receiver tuned to the transmitter frequency will enable a deeper null to be obtained due to its additional sensitivity.

J. ADJUSTMENT OF MIXER AND RF COILS

1. Place BAND switch on 80 meters.
2. Set RF tune control to 5.
3. Set FUNCTION switch to CAL and tune in the calibrator signal at 3.8 MHz.
4. Adjust T-7 and T-9 bottom for maximum S-meter reading.
5. Set BAND switch to 40 and RF TUNE to 7.
6. Tune in a calibrator signal at 7.3 MHz and adjust T-8 and T-10 top for maximum S-meter reading.
7. Set BAND switch to 20 and RF TUNE to 5.
8. Tune in CAL signal at 14.2 MHz and peak T-7 and T-9 top for maximum S-meter reading.
9. Set BAND switch to the center 10 meter band and the RF TUNE control to 5.
10. Set the SIDEBAND switch to "X" and FUNCTION switch to "X-CW" (Tuning at 28.8 MHz)
11. Slowly rotate the XMTR GAIN from its counter clockwise position until a definite increase in plate current is obtained.
12. Adjust T-8 and T-10 bottom for a peak in plate current, being careful not to allow the plate current to rise above .15 Amps for more than a few seconds at a time.
13. Return FUNCTION switch to SSB.

K. FINAL AMPLIFIER NEUTRALIZING

1. Attach an RF output indicator between the TR-4 and the dummy load. If a Heath Cantenna is used, a VTVM can be attached to it for RF output indication. If no external output indicator is available, the TR-4's own RF output indicator can be used. However, this is considerably more inconvenient for this purpose.
2. Load the TR-4 on 10 meters following "Tune Up Procedure", Section IV, Part C.
3. While tuning the PLATE control back and forth through resonance, adjust C-76, using an insulated screwdriver, until the plate current dip and maximum RF output occur simultaneously.

   CAUTION: THE ROTOR OF C-76 IS CONNECTED TO +250 VOLTS.

L. TRANSMITTING IF NEUTRALIZING

1. With microphone plugged into TR-4, turn VOX gain fully counter clockwise and turn XMTR GAIN fully clockwise. The FUNCTION switch should be left on SSB.
2. While talking into the microphone, increase RCVR GAIN until your speech can be heard from the speaker.
3. Adjust C-168 for minimum output from speaker.
4. If over one turn of adjustment is required, it will be necessary to realign T-14 and rebalance carrier, (See Paragraph G and I, Section VIII).

IX. AC-4 POWER SUPPLY

The R. L. Drake model AC-4 is a complete power supply capable of supplying all of the required voltages for our TR-3 and TR-4 Transceivers as well as our T-4 and T-4X/T-4XB Transmitters with the proper filtering and regulation. The unit may be operated from 120 or 240 VAC, 50 or 60 Hertz.

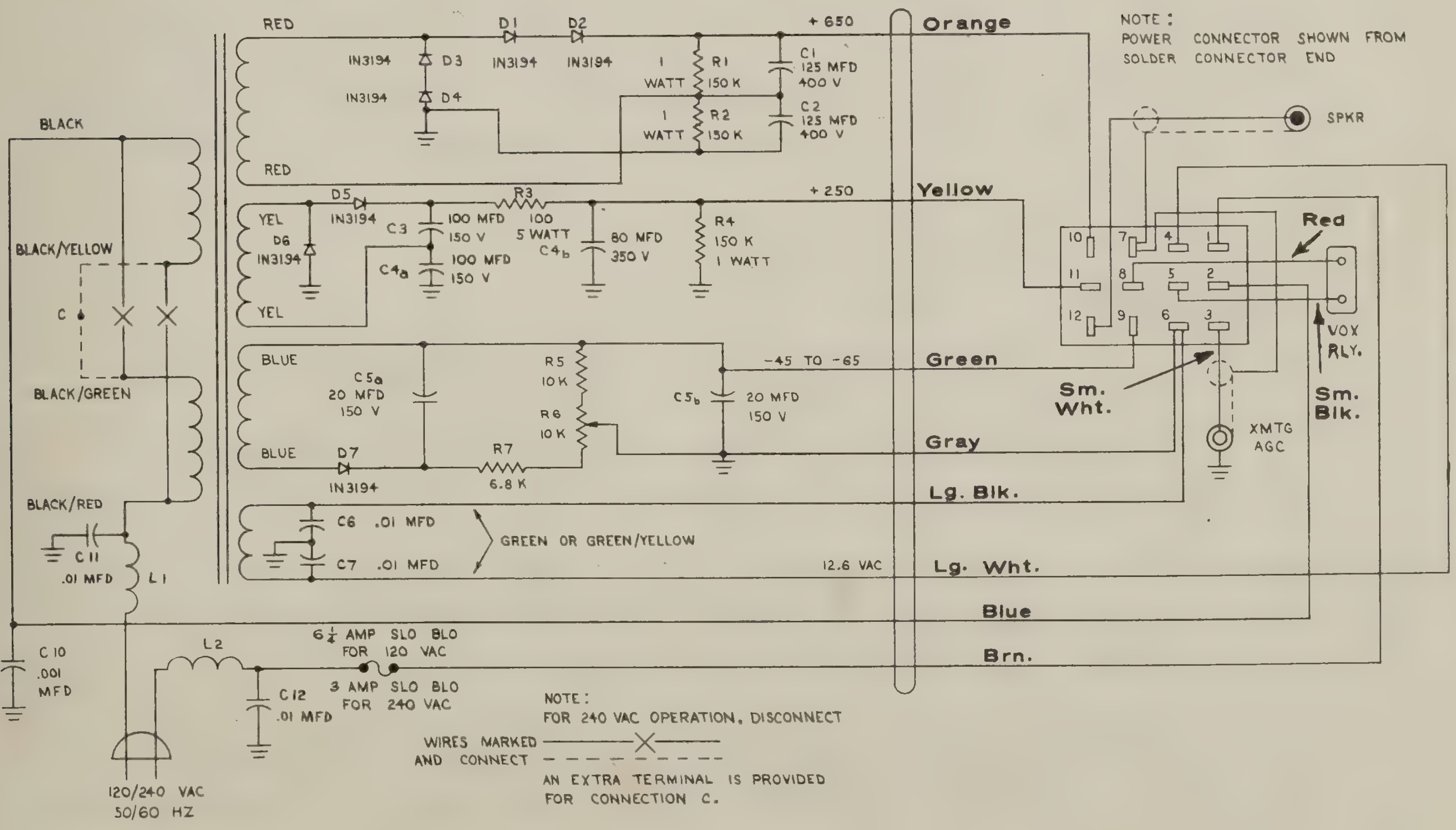
It is designed to fit into our MS-4 Matching Speaker or RV-4/RV-6 Remote VFO to become a single unit.

To mount it in these units, slide it in from the rear so that the line cord and power cable face outward. Fasten it in place with the four studded rubber feet provided with the unit.

To connect, plug the female power connector on the end of the power cable into the male connector on the rear of the TR-3, TR-4, T-4, T-4X or T-4XB. (See installation instructions for the appropriate equipment). A 6" lead terminated in a female phono plug extends from the power connector for connecting the MS-4 Speaker when the unit is used with our TR-3 or TR-4 Transceivers.

The bias adjustment should be set properly before any operation is attempted. (See TUNING PROCEDURE, Section IV).

IMPORTANT: Never ship the AC-4 mounted inside the MS-4 Speaker or RV-4/RV-6 case or serious damage to the case will result.



NOTE: POWER CONNECTOR SHOWN FROM SOLDER CONNECTOR END

NOTE: FOR 240 VAC OPERATION, DISCONNECT WIRES MARKED ——X—— AND CONNECT - - - - - - - - AN EXTRA TERMINAL IS PROVIDED FOR CONNECTION C.

FIGURE 16. AC-4 POWER SUPPLY SCHEMATIC DIAGRAM

X. DC-4 POWER SUPPLY

A. GENERAL DESCRIPTION

The R. L. Drake model DC-4 Power Supply is a self-contained power converter which transforms 12 V DC to the voltage necessary to operate our TR-4 , T-4XB, or T-4B. A receptacle supplying 115 V AC permits operation of the R-4B/T-4XB or T-4B combination.

B. SPECIFICATIONS

Input:	12 V DC
Output:	650 V DC at 300 mA average (500 mA peak) 250 V DC at 175 mA -45 to -65 V DC adjustable bias into 33 K ohms 115 V AC at 600 mA for receiver operation * (115 V AC at 1.3 A if used alone)
Frequency:	Approximately 330 Hertz square wave
Size:	8-1/2" Long, 4-1/4" Wide , 3-1/2" High
Weight:	7 pounds

* An ON-OFF switch to short Pins 1 and 2 of the S-312 CCE female connector should be used to provide 115 V AC output for applications other than an R-4B Receiver. A "Tube Saver" such as GC Electronics No.25-898 may be required for loads other than an R-4B. This is due to the extremely low cold resistance of some loads such as incandescent lamps, some TV sets, et cetera.

C. INSTALLATION

The DC-4 is supplied for use in cars with negative ground system.

DO NOT USE WITH POSITIVE GROUND SYSTEMS OR SERIOUS DAMAGE MAY RESULT.

We recommend that the DC-4 be mounted on the passenger side of the fire wall. It should not be placed in the trunk or in the engine compartment unless it is protected from water and engine heat.

Attach the short black wire of the cable assembly to the nearest convenient ground and run the red/white wire through the fire wall to the ungrounded terminal of the battery, or the "hot" terminal of the starter solenoid. Mount the fuse

C. INSTALLATION (Continued)

holder in a convenient location as near the battery as possible. Cut the black and red/white wires as short as possible to avoid unnecessary voltage drop.

Connect the DC-4 Power Supply to the transmitter using the cable assembly supplied. Coil up any excess cable and tape it in a convenient location.

Adjust the BIAS ADJ control, located on the end of the unit, as described in the transmitter instructions under TUNING PROCEDURE, Section IV.

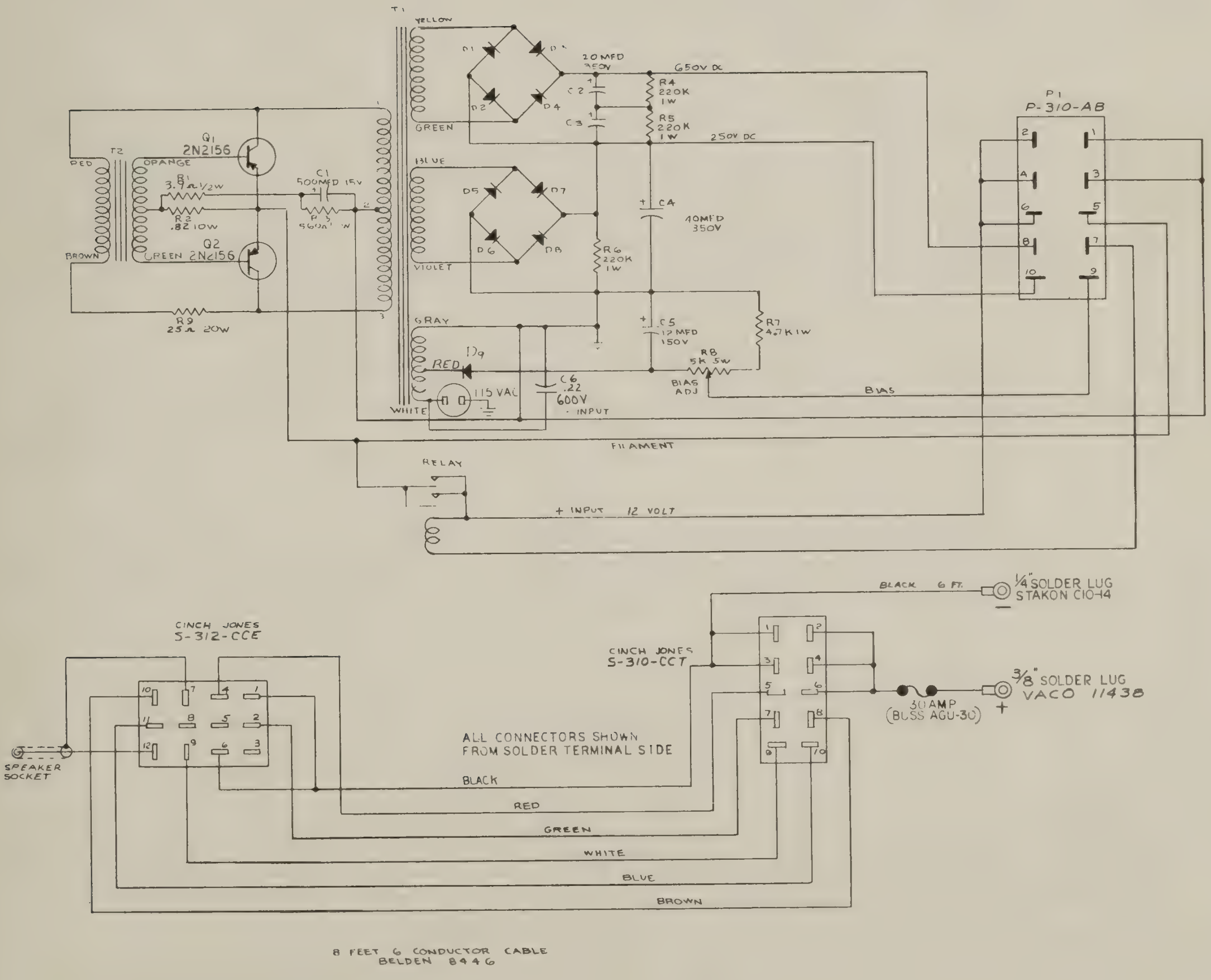


FIGURE 17. DC-4 POWER SUPPLY SCHEMATIC

XI. RV-4 REMOTE VFO INSTRUCTIONS

NOTE: If the old RV-3 is used with the TR-4, it must be modified as follows: Install a 22 K, 2 Watt resistor from Pin 1 of the OA2 to the terminal of the FUNCTION switch to which the Orange wire is attached.

The RV-4 is designed for use with the TR-3 or TR-4 Transceiver to permit reception, transmission, or both transmission and reception on a frequency removed from the VFO setting of the transceiver, but in the same band to which the transceiver is tuned. The RV-4 consists of a highly stable permeability tuned VFO, now employing an FET in its solid state design, a cathode follower and associated control circuitry.

The unit is housed in an attractive cabinet which matches the transceiver and contains a 5-inch 4 ohm speaker. Our model AC-4 (or AC-3) power supply can also be housed in this cabinet. (See AC-4 instructions.) The dimensions are as follows: 5-3/8" high, 10-3/4" wide and 11-1/8" deep. Weight 6-1/2 pounds.

INSTALLATION

To install the RV-4 with our TR-3, it will first be necessary to remove the bottom cover of the TR-3 and remove the jumper wire between Pins 2 and 8 of the RV-3 jack (J2). Now replace the bottom cover of the TR-3 and connect the RV-4 cable to J2. Connect the speaker lead to the 6-inch lead protruding from the AC-3 or DC-3 (AC-4 or DC-4) power cable connector. This completes the installation.

If it is desired to disconnect the RV-4 from the TR-3, it will be necessary to replace the RV-4 cable connector with a jumper plug. This plug should consist of an 8 conductor male plug (Cinch Jones Type P-308 with either the CCE, FHE, FHT, or CCT metal caps - remove cable clamps) with a jumper wire connected between Pins 2 and 8.

For use with the TR-4, it is necessary only to plug the RV-4 into the RV-4 plug J2 on the bottom of the TR-4 chassis. No jumper need be removed when the unit is installed nor is a jumper plug needed when it is disconnected.

NOTE: It is necessary to bond RV-4 chassis to transceiver chassis and to a good ground with a short piece of braid.

OPERATION

The RV-4 has two controls: The MAIN TUNING and the RV-4 FUNCTION switch. The MAIN TUNING control determines the frequency of the VFO and is calibrated in exactly the same way as the transceiver VFO. The RV-4 FUNCTION control has four positions: OFF, RCV, RCV/XMIT, and XMIT.

In the OFF position, the unit draws B+ and filament current but does not provide any output. The transceiver will transceive normally.

OPERATION (Continued)

In the RCV position, the RV-4 determines the receiving frequency and the transceiver VFO determines the transmitting frequency.

In the RCV/XMIT position, both transmit and receive frequencies are determined by the RV-4.

In the XMIT position, the RV-4 determines the transmitting frequency and transceiver VFO determines the receiving frequency.

The PTO indicator lamp is located directly above the MAIN TUNING knob. This lamp lights whenever the RV-4 is being used to control the frequency.

SERVICE DATA

We will check and factory align your RV-4 for a nominal fee of $5.00 plus transportation charges if the set has not been tampered with. If the repairs are necessary, we will advise you of the cost before proceeding with the work. Units that have been tampered with or misaligned will be repaired on a time and material basis.

A. REMOVAL FROM CABINET

1. If the AC-4 (or AC-3) power supply is installed in the RV-4 cabinet, it will first be necessary to remove it by removing the four screws holding it to the bottom of the RV-4 cabinet and sliding it out the rear.

2. Now loosen the six screws holding the RV-4 in the cabinet and slide it out the rear.

B. TUBE REPLACEMENT

In general, most trouble encountered in radio equipment of good design is due to tube failure. The RV-4 has been designed so that tube replacement can be done without need for realignment. The best method of finding defective tubes is direct substitution. It is best not to rely too heavily on tube checkers.

C. TROUBLESHOOTING

Careful consideration has been given in the design of the RV-4 to keep maintenance problems to a minimum. However, it is quite possible that some problem will arise which cannot be cured by tube substitution. If this occurs, we suggest that you either return your unit to your dealer or write direct to our Customer Service Department describing your problem in detail. Include full information concerning external connections, control settings, tube substitution, et cetera. Do not return equipment to the factory without prior authorization.

C. TROUBLESHOOTING (Continued)

The voltage and resistance charts and the schematic diagram should be valuable in isolating minor problems. However, no attempt should be made to service the RV-4 unless you are thoroughly familiar with electronic circuitry and servicing technique.

D. ALIGNMENT

The RV-4 is very carefully aligned at our factory and should require no further adjustment. If a tracking error in the VFO is noted, the unit should be returned to our factory.

However, if the unit has the same calibration error from one end of the dial to the other, and if the error cannot be corrected by the movable index line, the dial scale can be slipped slightly on its shaft until the discrepancy is eliminated.

The only adjustment in the RV-4 which should require any readjustment is coil L2. This coil is mounted inside the small aluminum can on the RV-4 chassis. To adjust proceed as follows:

1. Switch the RV-4 FUNCTION switch to RCV and tune its VFO to the 4.0 MHz crystal calibrator signal (Transceiver FUNCTION switch should be on CAL and BAND switch on 80.)

2. Tune L 2 for maximum S-meter reading. This completes the adjustment.

   Note that coil L3 has a value determined by the length of the cable connecting the RV-4 to the transceiver. Do not change the cable length or misalignment will result.

VOLTAGE CHART

Pin	1	2	3	4	5	6	7	8	9
V1	170	0	42	12.6*	0	170	0	4.2	6.3*

NOTE: These measurements were made from ground with an 11 Megohm VTVM. The RV-4 was connected to the transceiver which was in the receive condition. The RV-4 FUNCTION switch was on the RCV/XMIT position. An * indicates AC voltage.

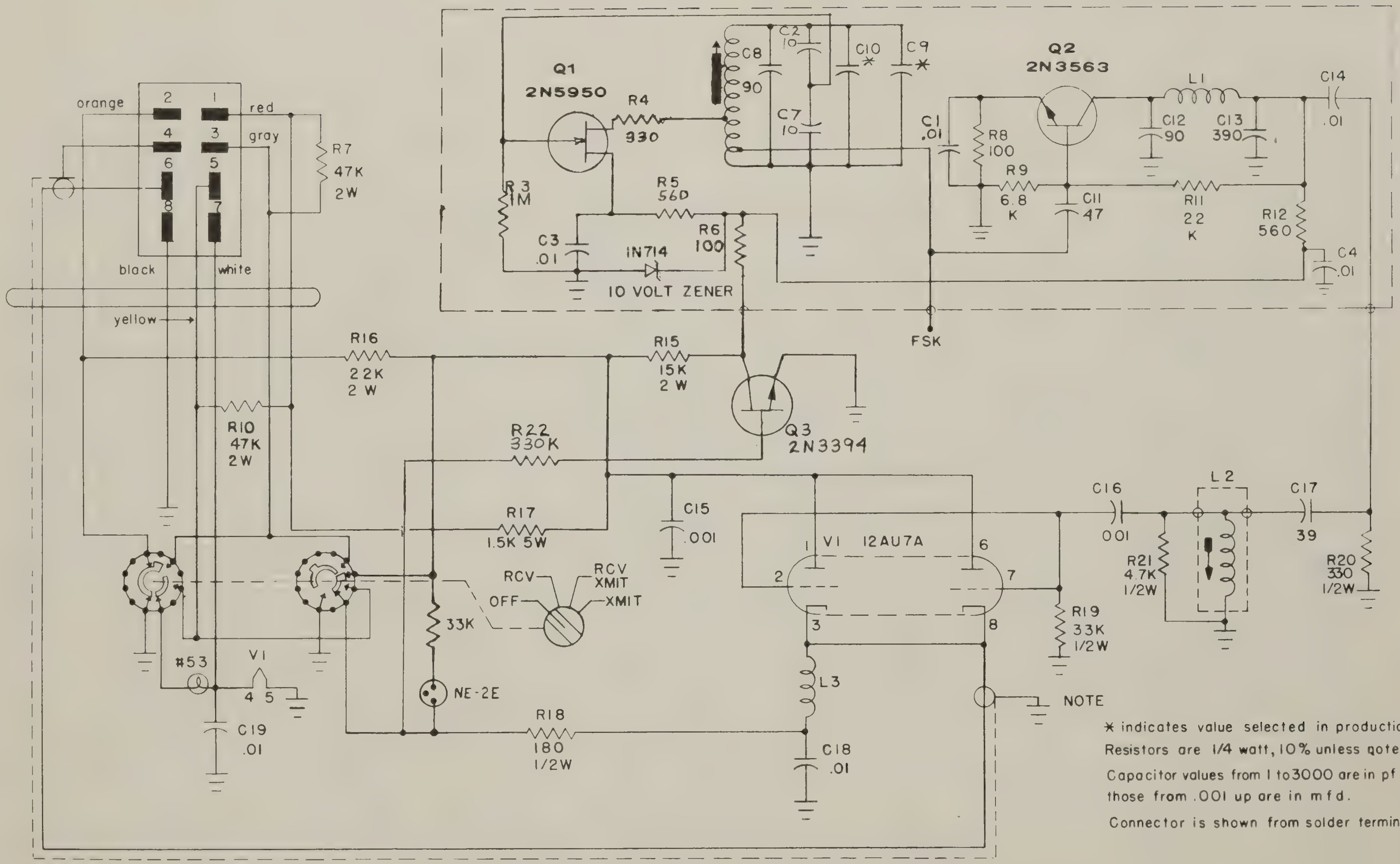
RESISTANCE CHART

Pin	1	2	3	4	5	6	7	8	9
V1	11K 8K	33K	180	0	0	11K 8K	33K	180	0

D. ALIGNMENT (Continued)

RESISTANCE CHART (Continued)

NOTE: These measurements were made from ground with the RV-4 connected to the transceiver but with the transceiver disconnected from the power supply. Where two resistances are shown, the top value was obtained with the RV-4 connected to the TR-3 and the bottom value was obtained with the unit connected to the TR-4. The RV-4 FUNCTION switch was in the RCV/XMIT position.



* indicates value selected in production.

Resistors are 1/4 watt, 10% unless qoted.

Capacitor values from 1 to3000 are in pf and those from .001 up are in mfd.

Connector is shown from solder terminal end.

SCHEMATIC DIAGRAM MODEL RV-4 REMOTE VFO

FIGURE 18

XII. FF-1 FIXED FREQUENCY ADAPTER

A. DESCRIPTION

The Model FF-1 Fixed Frequency Adapter is a solid state frequency determining unit. It provides crystal control of any two operating frequencies falling within the normal operating range of the TR-4 Transceiver. The FF-1 is well suited for net operation since it provides crystal controlled transmit frequency with VFO controlled receive frequency or crystal controlled transmit and receive frequency.

B. OPERATION

With the FF-1 in the OFF position, the TR-4 functions normally. In the "T" position, the transmit frequency is crystal controlled while the receive frequency is controlled by the VFO. In "T/R" position, transmit and receive frequencies are crystal controlled. In all cases, the red indicator lamp lights whenever the FF-1 is activated.

Two switch selected frequency channels are provided.

FF-1 MOUNTED UNDER TR-4

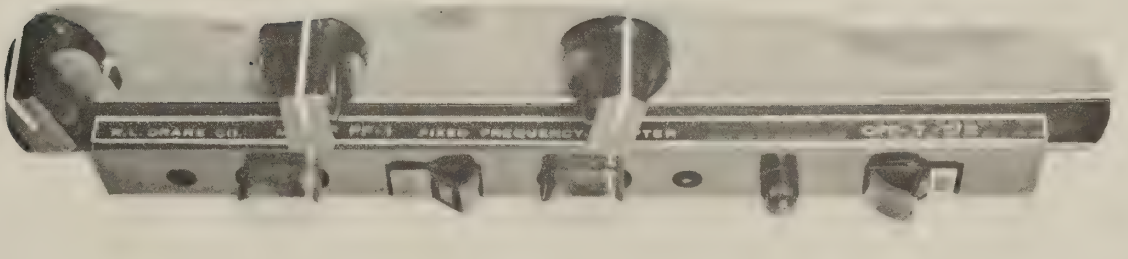


FIG.# 19

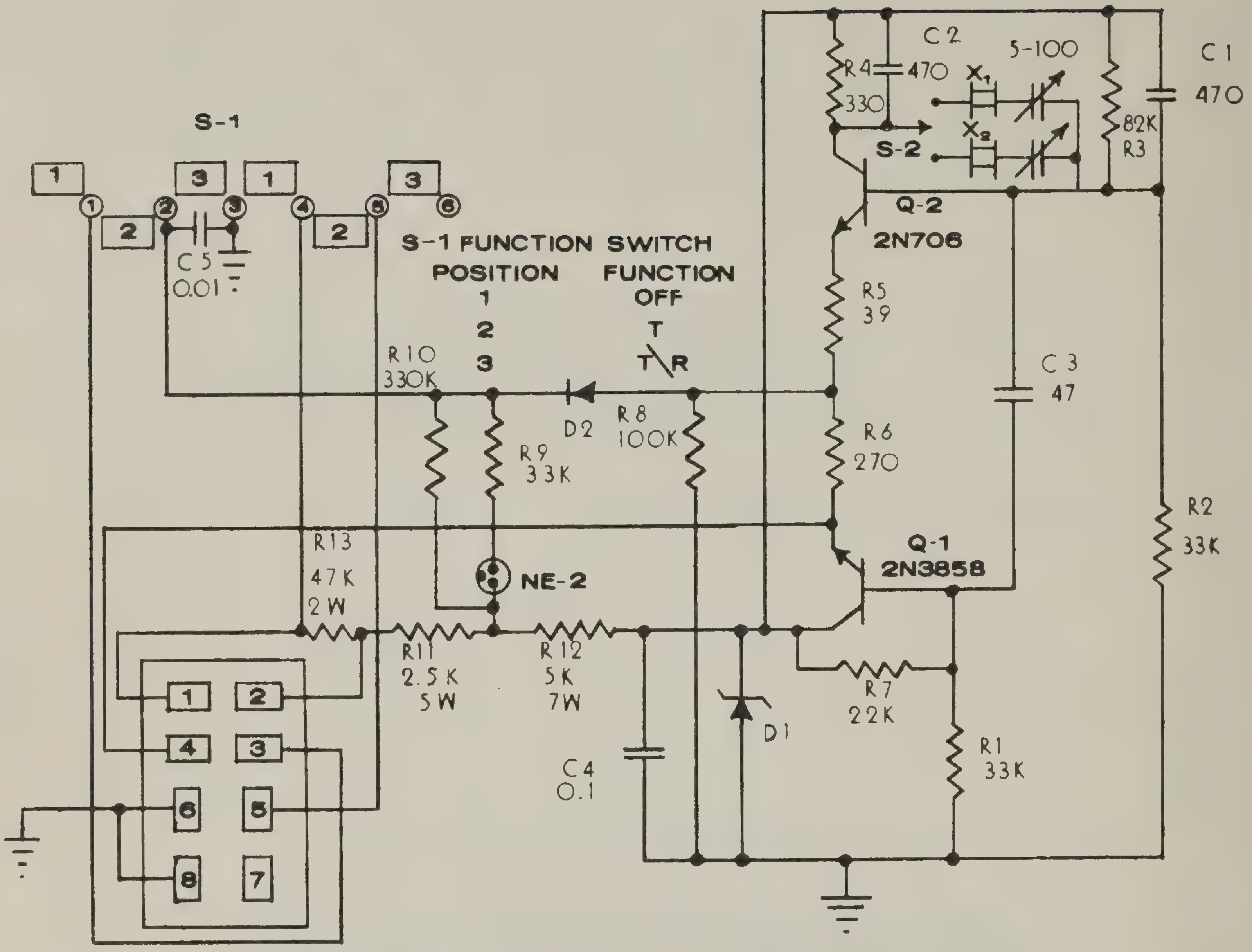


FIGURE 20. FF-1 FIXED FREQUENCY ADAPTER SCHEMATIC

XIII. 34-PNB PLUG IN NOISE BLANKER

A. GENERAL DESCRIPTION

This noise blanker is a solid state noise blanker.

Unlike noise clippers or limiters commonly found in communications equipment, this is an advanced noise blanker which actually mutes the receiver for the duration of the noise pulse. Between noise pulses full receiver gain is restored. (The receiver AGC is affected only by the desired signal strength, not by the noise at the antenna.)

This blanker is most effective on strong, periodic noise impulses such as ignition noise. The blanker is least effective on random noise (e.g. atmospheric or front end noise). This noise is continuous in time and the information it masks cannot be recovered by either blanking or limiting techniques. However, loss of communications due to random noise is a rare occurrence - generally impulse noise is responsible for such situations.

Low level signals masked by noise impulses without the noise blanker can be copied when the blanker is used. Noise blanking is a must for the mobile operator because he can now blank ignition noise due to trucks and other cars as well as his own car.

B. OPERATION

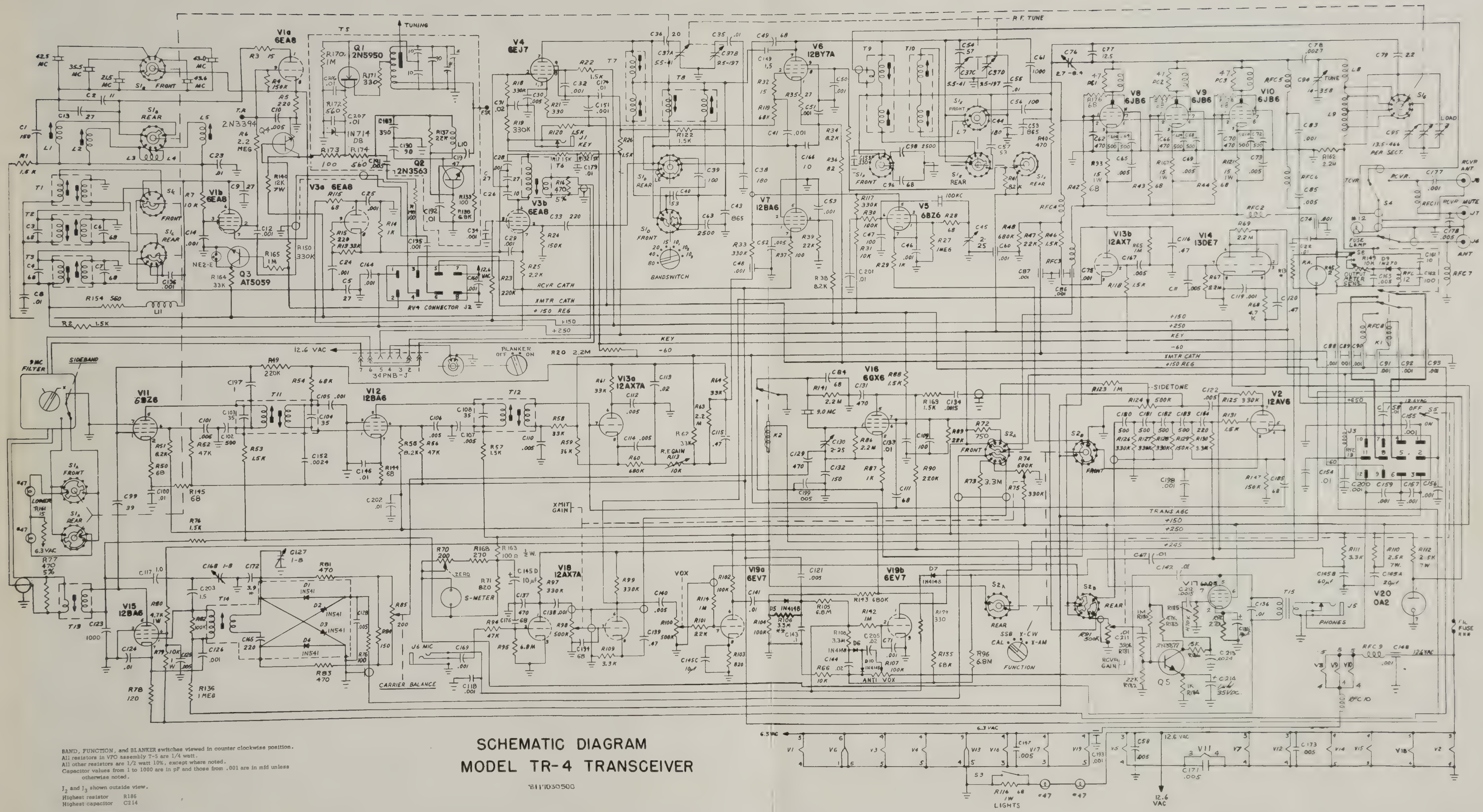
The noise blanker functions when the blanker switch is in the ON position. When transmitting, the position of the switch is unimportant.

In most situations, it is desirable to leave the blanker on continuously. However, it may happen you are copying an extremely weak signal under no noise conditions. In this situation, it may be advantageous to turn the blanker off since occasional peaks of atmospheric noise may trigger the blanker and generate additional noise.

C. INSTALLATION

Remove the power socket from back of the TR-4. Remove the top half of the TR-4 cabinet. Remove the 7 pin jumper plug located near the front of the power amplifier cage.

With the circuit side of the 34-PNB toward the side of the TR-4, carefully plug in the 34-PNB. After the 34-PNB is correctly seated in the socket, install the two #4 self taping screws in each corner of the 34-PNB bracket to secure it to the TR-4 chassis. Replace the cabinet top and screws and the blanker is now ready to use.



SCHEMATIC DIAGRAM
MODEL TR-4 TRANSCEIVER

8117030500

FIGURE 21

BAND, FUNCTION, and BLANKER switches viewed in counter clockwise position.
All resistors in VFO assembly T-5 are 1/4 watt.
All other resistors are 1/2 watt 10%, except where noted.
Capacitor values from 1 to 1000 are in pF and those from .001 are in mfd unless otherwise noted.

J_2 and J_3 shown outside view.

Highest resistor	R186
Highest capacitor	C214

* Value selected in production.
** Adjust to change VOX holding time.
*** Filament fuse is a 1-1/2" length of #26 tinned copper wire.

XIII. 34-PNB PLUG IN NOISE BLANKER

A. GENERAL DESCRIPTION

This noise blanker is a solid state noise blanker.

Unlike noise clippers or limiters commonly found in communications equipment, this is an advanced noise blanker which actually mutes the receiver for the duration of the noise pulse. Between noise pulses full receiver gain is restored. (The receiver AGC is affected only by the desired signal strength, not by the noise at the antenna.)

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Low level signals masked by noise impulses without the noise blanker can be copied when the blanker is used. Noise blanking is a must for the mobile operator because he can now blank ignition noise due to trucks and other cars as well as his own car.

B. OPERATION

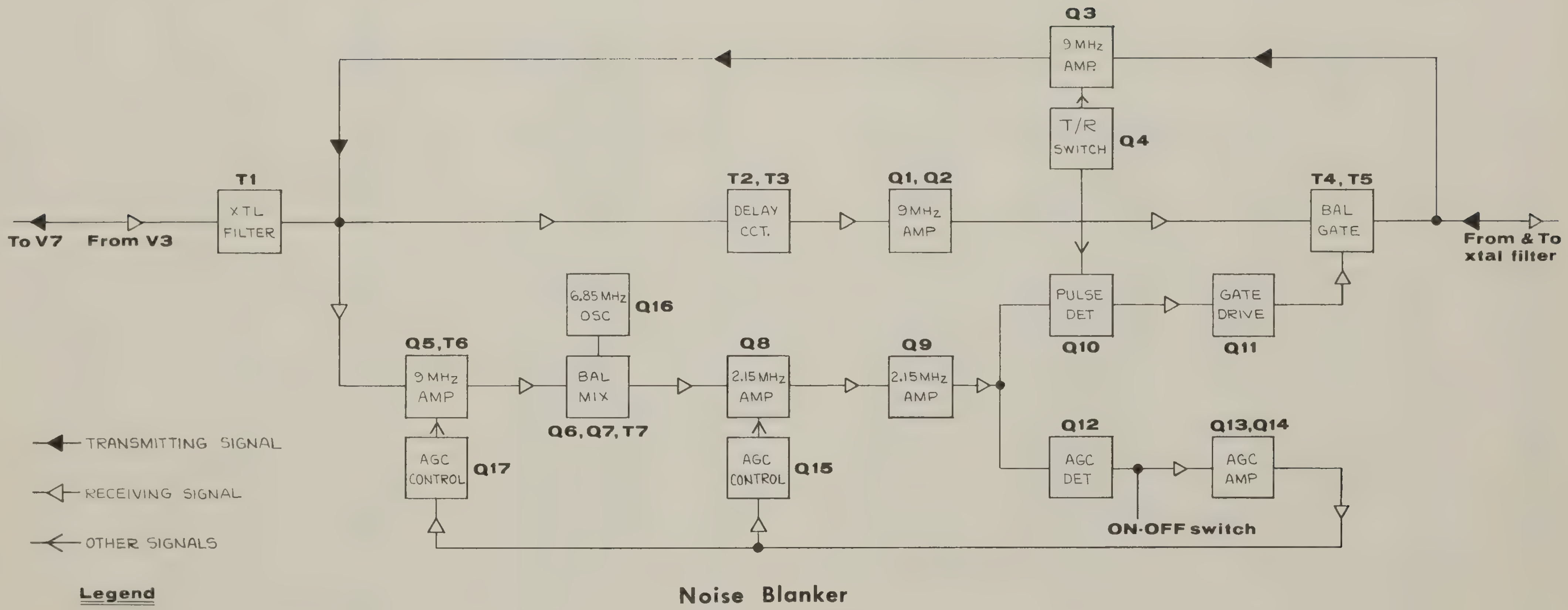
The noise blanker functions when the blanker switch is in the ON position. When transmitting, the position of the switch is unimportant.

In most situations, it is desirable to leave the blanker on continuously. However, it may happen you are copying an extremely weak signal under no noise conditions. In this situation, it may be advantageous to turn the blanker off since occasional peaks of atmospheric noise may trigger the blanker and generate additional noise.

C. INSTALLATION

Remove the power socket from back of the TR-4. Remove the top half of the TR-4 cabinet. Remove the 7 pin jumper plug located near the front of the power amplifier cage.

With the circuit side of the 34-PNB toward the side of the TR-4, carefully plug in the 34-PNB. After the 34-PNB is correctly seated in the socket, install the two #4 self taping screws in each corner of the 34-PNB bracket to secure it to the TR-4 chassis. Replace the cabinet top and screws and the blanker is now ready to use.



Noise Blanker

Fig. 22 Block Diagram

D. DESCRIPTION

This noise blanker system can be broken down into three major parts for the purpose of discussion.

The first part - the transmitting path - is the simplest. It consists of a single RC coupled 9 MHz amplifier which passes the transmit signal through the blanker as well as making up for any loss in the matching networks. The signal then passes through the crystal filter passband and into the transmit mixer.

The second part is the receiver path. Referring to the block diagram the signal first passes through a crystal filter with a bandwidth wide enough to pass most of the noise frequency components but narrow enough to keep strong adjacent signals from overloading the noise blanker amplifier. The signal simultaneously enters the noise processor (discussed later) and the delay circuit, a reactive network which compensates for the inherent phase shift of the noise processing section. The 9 MHz receive amplifier provides an overall system gain for the receive path. The balanced gate is a noiseless electronic series switch that opens for noise pulses but closes to allow the signal to pass.

The third part is the noise processor and the most complicated of all. The signal passes through the tuned 9 MHz amplifier and into the balanced mixer. This mixer converts the 9 MHz noise pulses to 2150 kHz and prevents the high level 6.85 MHz oscillator signal from reaching the amplifier strip. The 2150 kHz noise pulses travel through the two amplifiers, detector, and into the gate driver. The driver reverse biases the gate at the instant a 9 MHz noise pulse enters on its way to the receiver IF. The gate then is controlled by the same pulse it is blanking, enabling it to automatically respond to pulses of varying width.

If the noise blanker had been installed in the receiver IF strip near the detector, much circuitry could have been eliminated. The disadvantage to this shortcut method is deterioration in the noise performance due primarily to filter ringing. In other words, the noise pulse would encounter the non-linear phase response of the high "Q" crystal lattice filter and lengthen, masking more of the desired signal. The narrow crystal lattice filter would also remove the high frequency components of the noise pulse, thus reducing its rise time. The noise pulse is now highly distorted and the noise blanker has difficulty separating the pulse from the desired signal.

Although more expensive, we decided not to cut corners and designed the system for maximum noise performance - something the mobile operator especially will appreciate.

E. ALIGNMENT

1. T-6 Filter Match

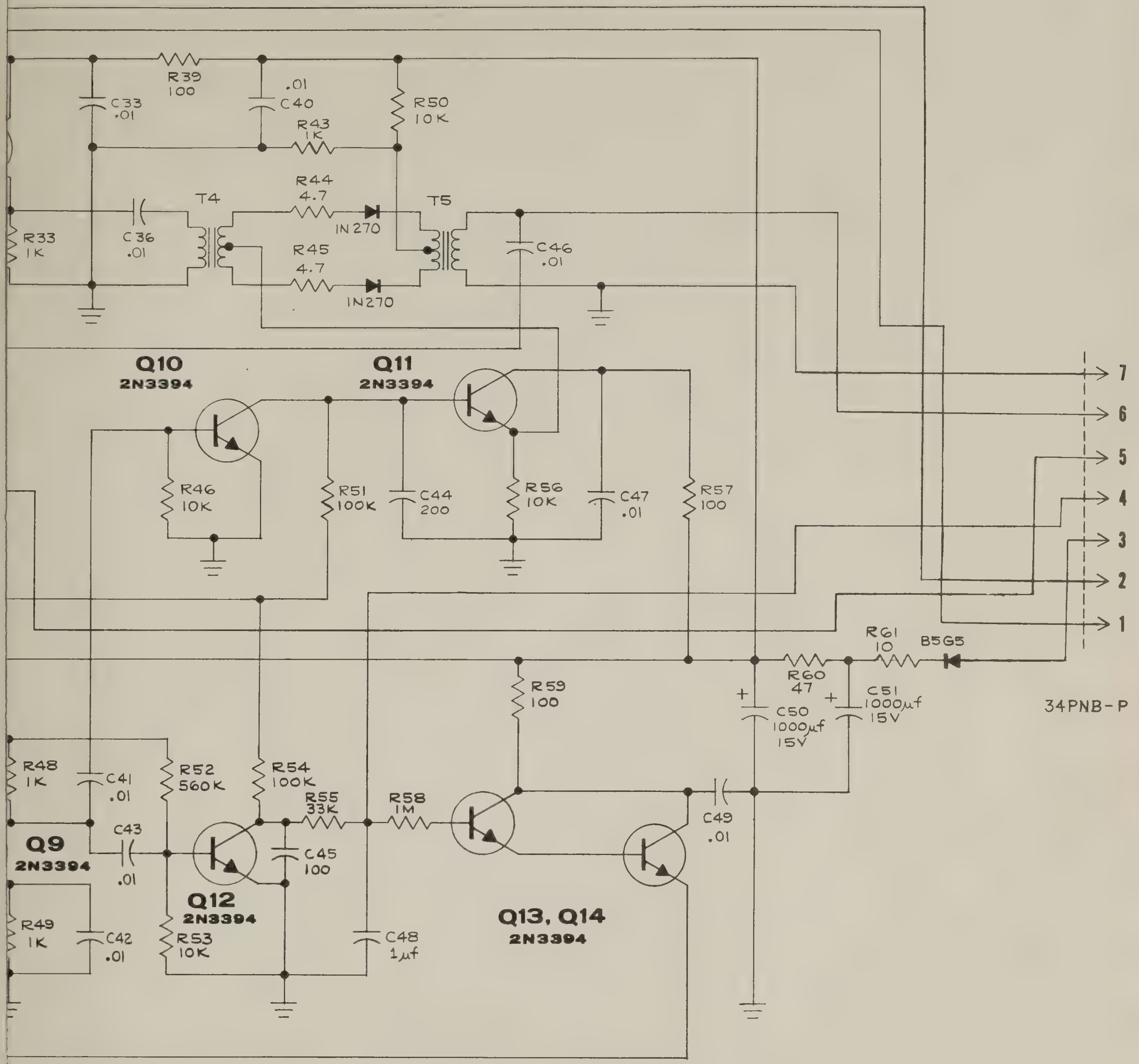
Refer to Section VIII, Paragraph H (Filter Matching Transformer) of TR-4 Alignment Instructions.

2. 9-NB Board Alignment

a. With the noise blanker turned on, adjust capacitor trimmers C_{10} and C_{19} for maximum S-meter reading on calibrator signal. (See Figure 22)

b. With the calibrator turned off, connect a VTVM (set to measure DC voltage) to terminal 8 of the 9-NB board and ground (terminal 8 being plus). Adjust R-24 for maximum positive voltage. (See Figure 22).

c. Turn the calibrator on and adjust the two remaining trimmers (C-21 and C-8) for minimum positive voltage. (See Figure 22).



NOTE:

1.) ALL CAPACITORS IN pf EXCEPT .001µf, .01µf

nker Schematic

E. ALIGNMENT

1. T-6 Filter Match

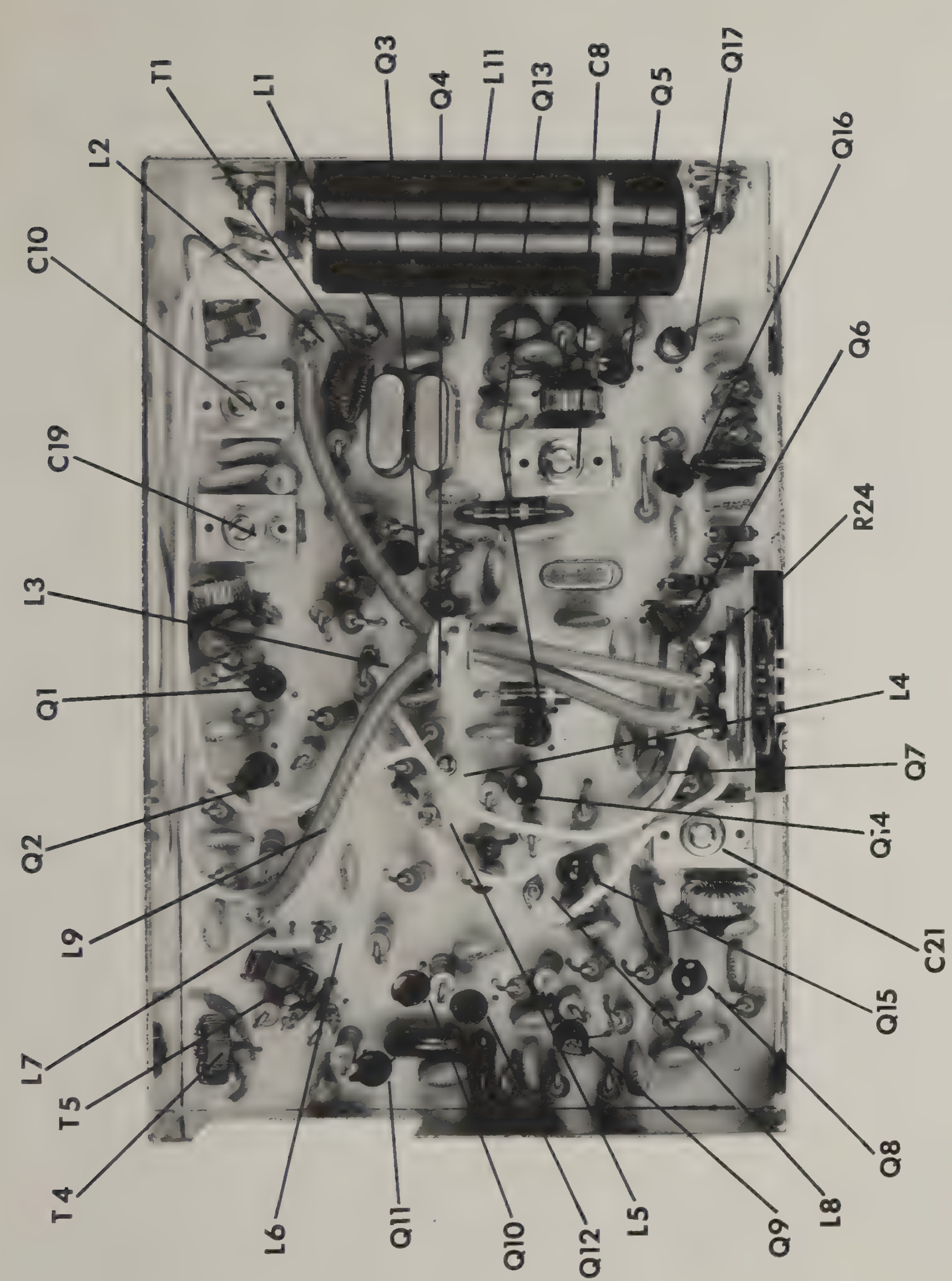
Refer to Section VIII, Paragraph H (Filter Matching Transformer) of TR-4 Alignment Instructions.

2. 9-NB Board Alignment

a. With the noise blanker turned on, adjust capacitor trimmers C_{10} and C_{19} for maximum S-meter reading on calibrator signal. (See Figure 22)

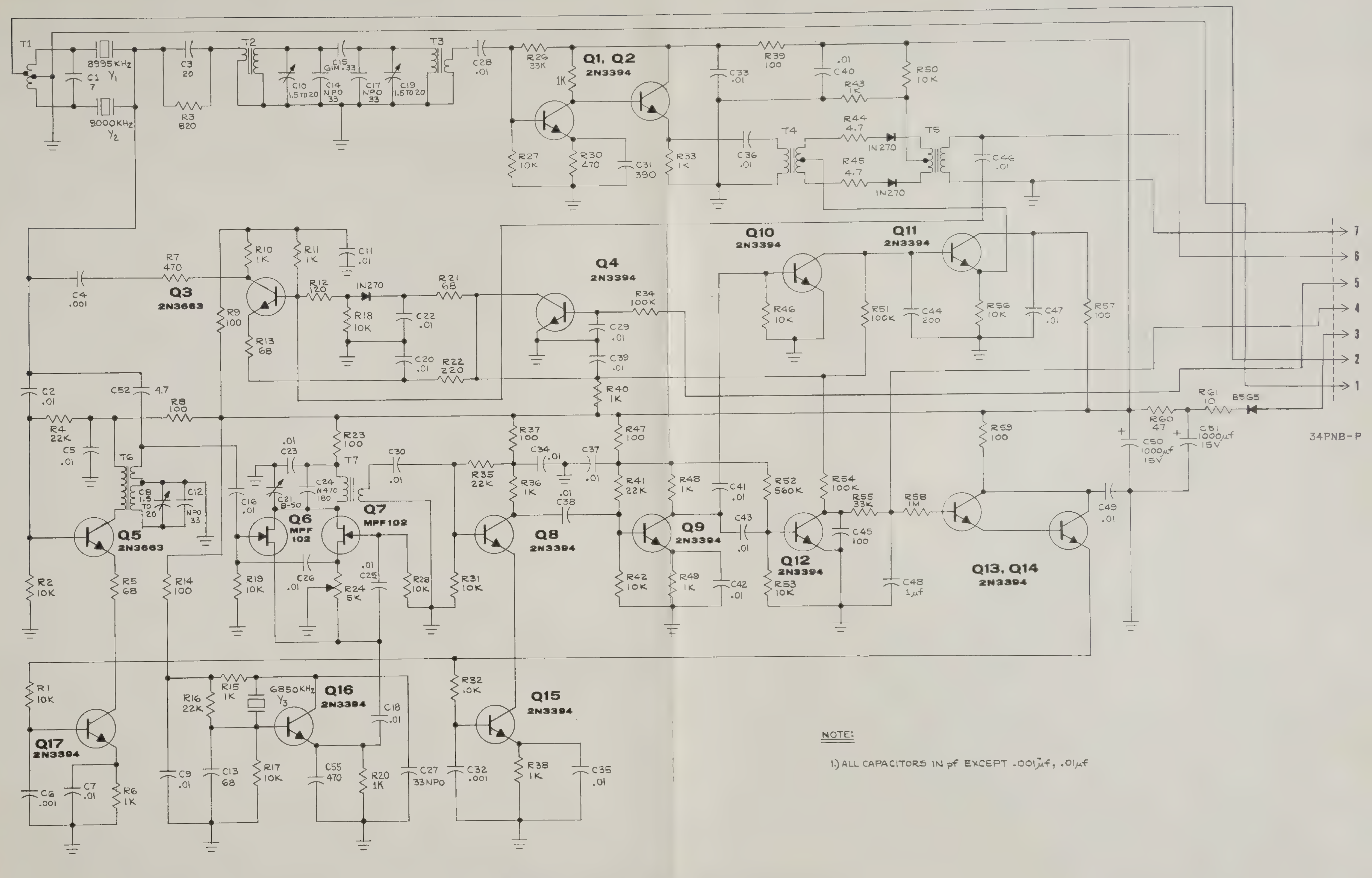
b. With the calibrator turned off, connect a VTVM (set to measure DC voltage) to terminal 8 of the 9-NB board and ground (terminal 8 being plus). Adjust R-24 for maximum positive voltage. (See Figure 22).

c. Turn the calibrator on and adjust the two remaining trimmers (C-21 and C-8) for minimum positive voltage. (See Figure 22).



CIRCUIT BOARD LAYOUT 34-PNB

FIGURE 23

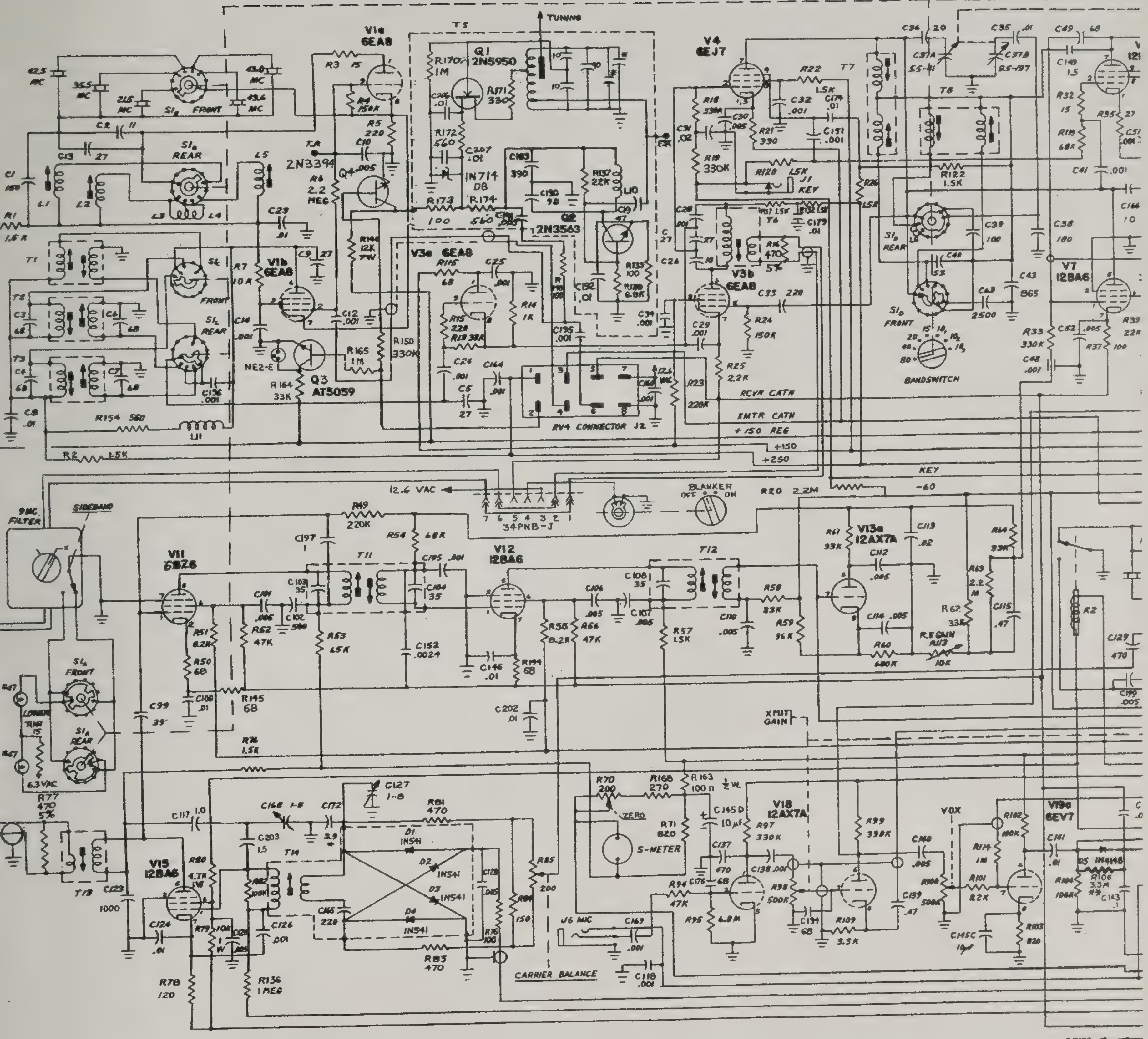


NOTE:

1.) ALL CAPACITORS IN pf EXCEPT .001µf, .01µf

34PNB Noise Blanker Schematic

FIG. 24



BAND, FUNCTION, and BLANKER switches viewed in counter clockwise position.
All resistors in VFO assembly T-5 are 1/4 watt.
All other resistors are 1/2 watt 10%, except where noted.
Capacitor values from 1 to 1000 are in pF and those from .001 are in mfd unless otherwise noted.

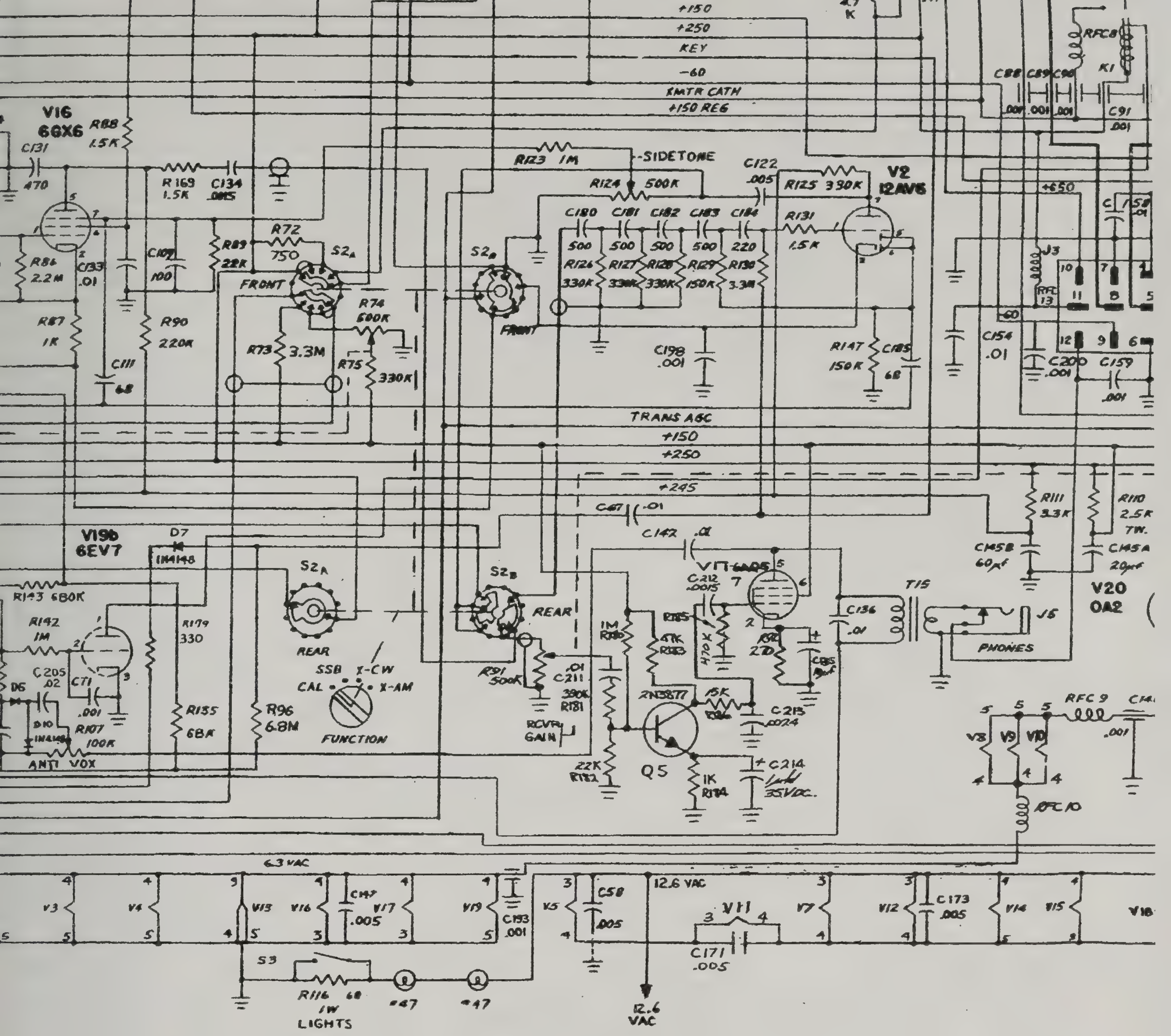
J_2 and J_3 shown outside view.
Highest resistor R186
Highest capacitor C214

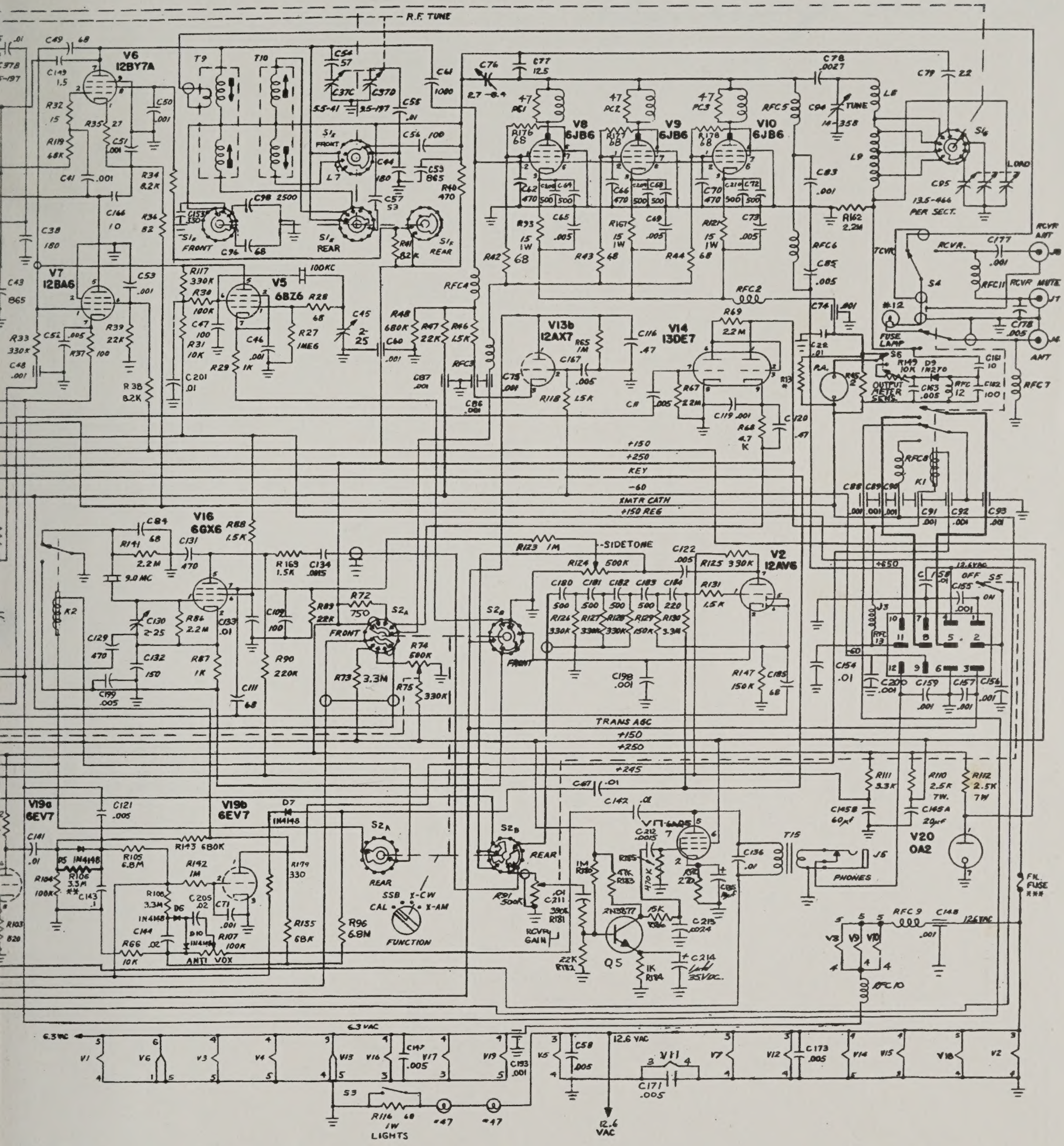
* Value selected in production.
** Adjust to change VOX holding time.
*** Filament fuse is a 1-1/2" length of #26 tinned copper wire.

SCHEMATIC DIAGRAM
MODEL TR-4 TRANSCEIVER

8117030500

FIGURE 21


+150
+250
KEY
-60
XMTR CATH
+150 REG
V16
6GX6
R88 1.5K
C131 470
R169 1.5K
C134 .005
R86 2.2M
C133 .01
C107 100
R89 22K
R72 750
S2A
FRONT
R87 1K
R90 220K
C111 68
R73 3.3M
R74 500K
R75 330K
R123 1M
-SIDETONE
R124 500K
C122 .005
R125 330K
V2
12AV6
C180 500
C181 500
C182 500
C183 500
C184 220
R126 330K
R127 330K
R128 330K
R129 150K
R130 3.3M
R131 1.5K
S2B
FRONT
C198 .001
R147 150K
C185 68
TRANS AGC
+150
+250
+245
C67 .01
C142 .01
+650
RFC8
K1
C88 .001
C89 .001
C90 .001
C91 .001
J3
RFC 13
C154 .01
-60
C200 .001
C159 .001
R111 3.3K
R110 2.5K 7W.
CM5B 60µf
CM5A 20µf
V20
OA2
V19b
6EV7
D7
1N4148
R143 680K
R142 1M
R179 330
C205 .02
D6
C71 .001
D10 1N4148
R107 100K
ANTI VOX
R135 68K
R96 6.8M
S2A
REAR
S2B
REAR
SSB
X-CW
CAL
X-AM
FUNCTION
R91 500K
C211 .01
390K R181
RCVR GAIN
1M R180
47K R183
2N3877
15K R186
C213 .0024
22K R182
Q5
1K R184
C214 1µf 35VDC.
V11-6AQ5
C212 .0015
R185 470K
R32 270
C85 10µf
C136 .01
T15
J6
PHONES
RFC 9
RFC 10
V8
V9
V10
.001
6.3 VAC
12.6 VAC
V3
V4
V13
V16
C147 .005
V17
V19
C193 .001
V5
C58 .005
V11
C171 .005
V7
V12
C173 .005
V14
V15
V18
S3
R116 68 1W
LIGHTS
#47
#47
12.6 VAC


R.F. TUNE
V6
12BY7A
V7
12BA6
V5
6BZ6
T9
T10
L7
S1F FRONT
S1E REAR
S1F REAR
100KC
V8
6JB6
V9
6JB6
V10
6JB6
V13b
12AX7
V14
13DE7
C94 TUNE
L8
L9
S6
LOAD
C95 13.5-466 PER SECT.
RFC5
RFC6
RFC4
RFC3
RFC2
RFC7
RFC8
K1
S4
RCVR ANT
RCVR MUTE
ANT
TCVR
RCVR.
FUSE LAMP
P.A.
OUTPUT METER SENS.
+150
+250
KEY
-60
XMTR CATH
+150 REG
V16
6GX6
9.0 MC
K2
-SIDETONE
V2
12AV6
S2A
S2B
FRONT
+650
12.6VAC
S5
OFF
ON
J3
TRANS AGC
+150
+250
+245
V19a
6EV7
V19b
6EV7
D7
1N4148
D5 1N4148
D6
D10
ANTI VOX
SSB
X-CW
CAL
X-AM
FUNCTION
REAR
RCVR GAIN
V17 6AQ5
Q5
2N3877
T15
J6
PHONES
V20
OA2
FIL. FUSE ***
RFC 9
RFC 10
12.6VAC
6.3VAC
6.3 VAC
12.6 VAC
S3
LIGHTS
#47
#47
12.6 VAC

9-14-87
RepLACEd
FiLTer CAPS
IN POWER SUPPLY

R.L. Drake Co-
540 Richard st.
Miamisburg, Ohio 45342

Litho in U.S.A.